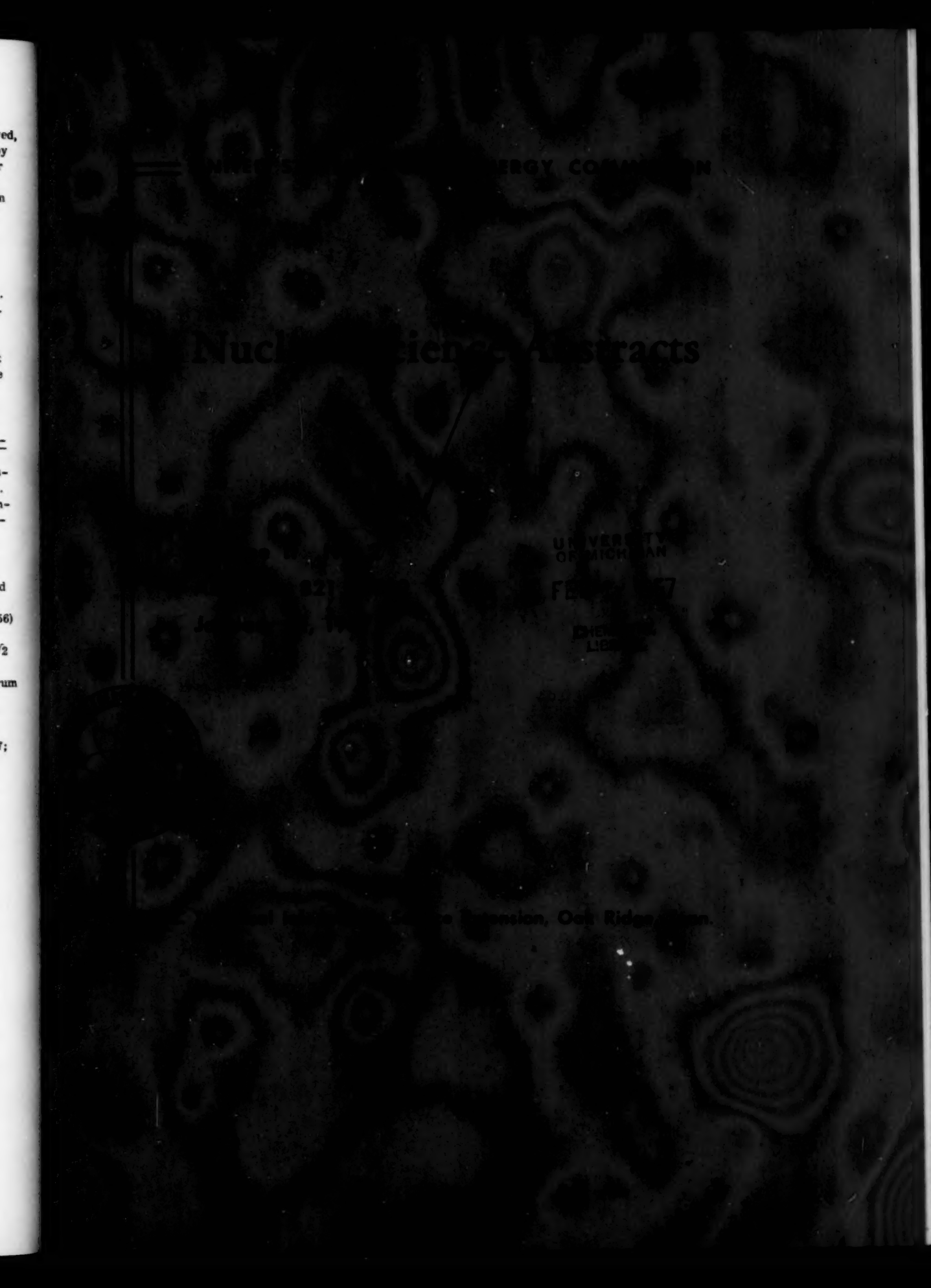

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NUCLEAR SCIENCE ABSTRACTS

Volume 11 January 31, 1957 No. 2

GENERAL

ATOMIC POWER

821 AECU-3185

Rocky Mountain Nuclear Power Study Group, Idaho Falls, Idaho.

ANNUAL PROGRESS REVIEW FROM NOVEMBER 1, 1954 THROUGH OCTOBER 31, 1955. 33p.

Some economic aspects of nuclear electric power production are considered. Capital costs, and fuel costs are estimated for several reactor systems and compared with coal-fired steam plant costs for the Rocky Mountain area. (T.R.H.)

822 T-42 (Pt. II(RAND))

THE PROBLEMS OF UTILIZING ATOMIC ENERGY. SOURCES OF NUCLEAR FUEL. Translated by F. J. Krieger from Krasnaya Zvezda, p.3(1954) Sept. 2. 9p. (AD-107409).

This is one of a series of articles entitled The Problems of Utilizing Atomic Energy published in the Soviet Minstry of Defense organ Red Star in August, 1954. Uranium, thorium, and hydrogen as sources of nuclear fuel are discussed in an elementary fashion. The factual information is admittedly of non-Soviet origin. (C.H.)

823 T-58(RAND)

STEADY NUCLEAR COMBUSTION IN ROCKETS. (Stationäre Kenverbrennung in Raketen). E. Sänger. Translated by R. D. Holbrook from paper given at Fifth I.A.F. Congress at Immsbruck on August 5, 1954. 55p.

Theories of stationary nuclear reactions are reviewed. Under these restrictions it appears fundamentally possible to continuously maintain steady nuclear combustions at realizable pressures and dimensions and one can visualize their application as sources of energy for power plants and propulsion units. Three basic methods for utilizing the enthalpy of nuclear combustion gases (of the order of 10^{10} kcal/kg) in jet propulsion units suggest themselves: The simple expansion of the nuclear combustion gases in pure atomic rockets, the mixing of the reaction gases with surrounding air or with other inert working gases in turbo- or ramjets or thermal atomic rockets, and the conversion of energy into a photon gas in photon rockets. For the latter two methods the combustion pressures available appear to be insufficient to ensure the furnace charges necessary. On the other hand, the technical conditions for the operation of steady nuclear fires in central power stations, marine propulsion plants, or in pure atomic rockets of very large size seem much more attainable. (auth)

RESEARCH PROGRAMS

824

INDEX TO THE TWENTIETH SEMIANNUAL REPORT TO CONGRESS OF THE U. S. ATOMIC ENERGY COMMISSION. Washington, U. S. Government Printing Office, 1956. 26p. $0.15.

Subject and author indexes to the United States Atomic Energy Commission's Twentieth Semiannual Report to Congress are given. This index supplements a cumulative index to the first fifteen Semiannual Reports of the Commission and a separate index to the Sixteenth, Seventeenth, Eighteenth, and Nineteenth Semiannual Reports. (F.S.)

825

MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS—JANUARY – JUNE 1956. Washington, U. S. Government Printing Office, July 1956. 260p. $1.25.

In addition to an extensive outline of AEC research and development activities, appendixes are included on health and safety precautions for Eniwetok tests, allocation of U^{235}, isotope distribution data, and regulations of the AEC. (F.S.)

BIOLOGY AND MEDICINE

826 UR-467

Rochester, N. Y. Univ. Atomic Energy Project.

SOME CONTRIBUTIONS OF LEUKOCYTE BALANCE STUDIES TO LEUKOCYTOPHERESIS. M. Ingram. Aug. 24, 1956. 16p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

827

CALCULATIONS AND MEASUREMENTS OF THE DOSE IN TOTAL-BODY IRRADIATION BY β-PARTICLES. V. A. Petrov (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, No. 4, 81-8(1956) July-Aug. (In Russian)

A method has been developed for determining the magnitude of the dose on the body of an animal exposed to total-body β irradiation. Equations are given for corrective coefficients for cylindrical ionization chambers. (R.V.J.)

RADIATION EFFECTS

828 AD-88913

American Meat Inst. Foundation, Chicago.

RADIATION SENSITIVITY OF MEAT SPOILAGE MICROORGANISMS. Report No. 9 (Termination) [for] June 15, 1954–January 14, 1956. C. F. Niven, Jr. 19p. Project No. 7-84-01-002. Contract DA-44-109-qm-1769.

A study was made of the radiosensitivity of the bacteria that limit the shelf life of cured meat products. Data are tabulated on the identity, radiation resistance, and factors affecting radiation resistance of organisms responsible for the spoilage of fresh beef and the production of slime on the surface of frankfurters during refrigerated storage. Particular attention was devoted to studies of the radiation resistance of organisms causing food poisoning. The effectiveness of moderate doses of ionizing radiations in delaying the onset of spoilage of cured meat foods stored under refrigeration is discussed briefly. (C.H.)

829 AD-93752

Massachusetts Inst. of Tech., Cambridge.

DEVELOPMENT OF A METHOD OF RADIATION STERILIZATION OF FOODS WITHOUT ADVERSE FLAVOR AND CHEMICAL CHANGES. Progress Report No. 5 [for] December 1, 1954–March 31, 1955. B. E. Proctor. 44p. Project No. 7-84-01-002. Contract DA-44-109-qm-1746.

After having been irradiated with cathode ray doses in

the range of 1.5×10^6 to 2×10^6 rep, bacon, corned beef, Brussels sprouts, and sweet potatoes were found to be acceptable in flavor, but frankfurters, liverwurst, salami, and squash were not acceptable. Seasoning hamburg with salt and pepper prior to irradiation seemed to minimize the off-flavor. The off-flavor in irradiated hamburg was not completely obviated by vacuum treatment of the meat, and attempts to eliminate the off-flavor by adsorbing the off-odors on activated carbon gave inconsistent results. A number of chemical compounds were used to treat hamburg before irradiation. Dihydroxymaleic acid appeared to have some influence on reduction of irradiation flavor, as did the use of serine. Further studies are in progress. No significant difference in flavor was noted between irradiated chicken meat from freshly slaughtered birds and irradiated chicken meat from slaughtered birds purchased in regular channels and pre-packaged before purchase. Taste panels indicated no significant preference for irradiated white meat of chicken when compared with irradiated dark meat. Inconsistent results were obtained in flavor tests with beefsteak, lima beans, and broccoli after irradiation. Flavor tests were also conducted on various other irradiated food products, including raisins, prunes, cherry gelatin dessert powder, chocolate pudding dessert powder, white bread, and molasses. Asparagus, green beans, spinach, sweet potatoes, and codfish cakes were commercially sterilized with a dose of 1.5×10^6 rep. The commercial sterilizing dose for bacon was 1×10^6 rep. (auth)

830 AECU-3152

Michigan. Univ., Ann Arbor.

STUDY OF THE BIOLOGICAL EFFECTS OF IRRADIATION. Progress Report for the Period of January 16, 1955 to January 15, 1956. Richard L. Potter, Frank H. Bethell, David F. Bohr, H. Owen France, Henry J. Gomberg, Sylvester E. Gould, James W. Lineman, and John B. Villella. 173p. Contract AT(11-1)-75. $27.30 (ph OTS); $8.10(mf OTS).

Evidence is presented for the occurrence of six pyrimidine deoxynucleotides in the acid-soluble extract of calf or rat thymus. It is suggested that these compounds are of primordial importance as intermediates in DNA synthesis. Results are reported from a series of irradiation experiments evaluating the protective effect of small lead shields. In two series of these experiments the local strain of rats used differed from the Sprague-Dawley strain in that they were more sensitive to whole-body irradiation if unshielded and they were more effectively protected by the shielding procedures. Preliminary experiments on rats indicated that satisfactory renal function data may be obtained in the anesthetized rat using techniques based on a constant rate of infusion of the clearance material and short clearance periods demarked by accurately timed bladder rinses. Unilateral kidney function can be evaluated in the rat immediately after centralateral nephrectomy. Data are presented from a study on the biological and physiological nature of an erythropoietic stimulating factor isolated from boiled extracts of anemic rabbit plasma. Studies on the control of Trichinella spiralis are reported. Results are reported from studies on the effects of radiation on the infectivity of eggs of Ascaris lumbricoides and on Hymenolepis nana. Experiments are reported on the characterization and isolation of unstable serum factors that appear to mediate some of the after effects of irradiation exposure and to have a role in radiation-induced interference with growth and metabolism in rats. (For preceding period see AECU-3139.) (C.H.)

831 AF-SAM-55-110

Texas. Univ., Austin. Radiobiological Lab.

AN ATTEMPT TO DEMONSTRATE A LETHAL TOXIN IN THE BLOOD OF IRRADIATED RATS. James R. Lott and James L. Wilding. May 4, 1955. 5p.

A series of experiments was conducted in an attempt to demonstrate a circulating toxin in the blood of irradiated rats. At 1, 6, and 24 hr postradiation, 5 ml of blood from irradiated animals were transfused into normal animals which had been simultaneously exsanguinated in identical amounts. A total of 101 rats was irradiated by Co^{60} γ radiation in doses of 1,000 r through 20,000 r and their blood transfused into normal rats. It was found that after an initial weight loss all surviving animals gained weight over a 30-day period and no deleterious effects of the transfused irradiated blood were observed. (auth)

832 BNL-412

Brookhaven National Lab., Upton, N. Y. and Naval Medical Research Inst., Bethesda, Md.

MEDICAL SURVEY OF MARSHALLESE TWO YEARS AFTER EXPOSURE TO FALLOUT RADIATION. R. A. Conard, Bradford Cannon, C. E. Huggins, J. B. Richards, and Austin Lowery. Mar. 1956. 18p. $0.20(OTS).

The medical survey of the Rongelap people two years after exposure to fallout radiation shows that the people appear to have been in a generally good state of health and nutrition and are making satisfactory recovery from their radiation exposure. Serious illness has occurred in two individuals but neither these illnesses nor clinical findings in other individuals can be attributed to radiation effects. One death in May 1956, that of a 46-year-old Rongelap man, was due to hypertensive heart disease. Previous examinations had shown that the disease was undoubtedly present at the time of exposure to fallout radiation. There is evidence of continued improvement of hemopoiesis. The mean lymphocyte count is slightly increased over the one-year levels, but is still slightly below the mean control count. The mean platelet level is about the same as found at one year after exposure and is still slightly below the control level. The mean neutrophile count at one year after exposure had reached the control level. The delay in complete recovery of lymphocytes and platelets is similar to that reported in the two-year follow-up studies of the Japanese casualties of the atomic bombings. Evidence from the Marshallese experience indicates that the lowered levels of these blood elements have not lowered the resistance of the people to disease, and the present levels are not considered to represent a serious condition. Residual changes in the skin from β irradiation continue to show improvement. Pigment aberrations are still evident in 15 cases and in four of these there is also scarring with some adherence of the skin to the subcutaneous tissue. However, there is no gross evidence of tissue breakdown or malignant change in any of these lesions, and surgical repair is not considered necessary at this time. Histological examination of skin biopsies at sites of radiation lesions shows residual effects of radiation damage, but no evidence of premalignant or malignant changes. Ophthalmological survey reveals that there are no radiation-induced lens opacities, and the incidence of ocular lesions is similar in exposed and control populations. The radiochemical analysis of the urine of the Rongelap people shows measurable activity which is largely due to cerium-144–praseodymium-144 with only slight activity due to strontium-90. The body burden of these isotopes is estimated to be well below the permissible levels. Examination of bone specimens in the case of the one man who died shows no radiation that can be def-

initely associated with fallout deposition in the bones. Studies of radiographs of the femurs of the exposed children show no evidence of any bone defects from possible deposits of radionuclides. (auth)

833 TID-5220

Argonne National Lab., Lemont, Ill.

BIOLOGICAL EFFECTS OF EXTERNAL X AND GAMMA RADIATION. PART II. Raymond E. Zirkle, ed. Aug. 1956. 487p. $2.10(OTS).

Part I of this report was issued as NNES-IV-22B.

Data are presented from a number of studies on the biological effects of various doses of external x and γ radiation on laboratory animals. Data are included on the physiological effects of ionizing radiation in animals, studies in porphyrin metabolism, the effects of total-body irradiation on growth, organ weight, susceptibility to parasites, blood picture, liver function, and body water content; the effects of age on radiosensitivity; and the effects of rate of exposure on radiosensitivity. Related studies reported include the preparation of samples of morphologically intact leukocytes from peripheral blood and the use of ion exchange resins for the purification of urinary purines, kynurenic acid, and coproporphyrin. Numerous references, and author and subject indexes are included. (C.H.)

834 TID-5358

Naval Medical Research Inst., Bethesda, Md.; Naval Radiological Defense Lab., San Francisco; and Brookhaven National Lab., Upton, N. Y.

SOME EFFECTS OF IONIZING RADIATION ON HUMAN BEINGS. A Report on the Marshallese and Americans Accidently Exposed to Radiation from Fallout and a Discussion of Radiation Injury in the Human Being. E. P. Cronkite, V. P. Bond, and C. L. Dunham, eds. July 1956. 114p. $1.25(GPO).

On March 1, 1954, an experimental thermonuclear device was exploded at the Eniwetok Proving Grounds in the Marshall Islands. Following the detonation, unexpected changes in the wind structure deposited radioactive materials on inhabited atolls and on ships engaged in the test. Radiation surveys of the areas revealed injurious radiation levels and evacuation was ordered immediately. The degree of radiation injury of each exposed individual was assessed as quickly as possible, and appropriate care and study of the injured was instituted without delay. The initial data have been supplemented by field resurveys 6 and 24 months after the original investigation. The results of this work are summarized. (36 photographs.) (C.H.)

835 UR-464

Rochester, N. Y. Univ. Atomic Energy Project.

THE HAZARD OF USING THE GOVERNMENT ISSUE CREAM FOR PROTECTION AGAINST FLASH BURNS. H. W. Bales, J. R. Hinshaw, H. E. Pearse, and J. A. Basso. Oct. 9, 1956. 20p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Our recent study of burns under black and white paint films indicated that energy absorbed by the films contributes greatly to burn severity. This led to an evaluation of the flash cream issued by the Government for military use. Because it was impossible to apply the recommended $^1/_{16}$ inch layer of cream even with a template and spatula, a thinner, more realistic layer was used in these experiments. The median effective exposures necessary to produce 2+ burns at exposure times of 0.3 sec, 3.0 sec, and 30.0 sec, were determined for bare skin and for skin covered with the Government Issue cream. At the two shorter exposure times, only one-half as much energy is required to produce a 2+ burn on skin treated with the protective cream as is needed when the skin is bare. This conclusion was so startling that the results were checked in another way. A constant radiant exposure of 3.5 cal/cm^2 was delivered in 0.3 sec to a number of bare and cream-covered exposure sites. Surface and microscopic evaluations of the severity of the burns revealed that burns under the cream were about two times deeper than those produced on bare, unprotected skin. In addition, it was found that the cream can be ignited with a match and, if it is applied to the skin in the thickness recommended, it will burst into flame at exposures of 15 cal/cm^2 delivered in one sec. Thus, this cream, which is issued as a protective device, is actually a hazard. (auth)

836 UR-465

Rochester, N. Y. Univ., Atomic Energy Project.

THE RESPONSE OF DOGS TO BILATERAL WHOLE BODY Co^{60} IRRADIATION. PART I. LETHAL DOSE DETERMINATION. James N. Shively, Sol M. Michaelson, and Joe W. Howland. Oct. 17, 1956. 13p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

The mid-line tissue LD-50/30 for dogs exposed to bilateral irradiation from a Co^{60} source has been estimated to be 335 r with 95% confidence limits of 310 to 358 r. The mean day of death was 17.3 days. The Co^{60} mid-line tissue LD-50/30 dose is higher than that reported for x-ray. This dose, however, is essentially the same as that for unilateral x-irradiation applied to the dorsal aspect. (auth)

837 AEC-tr-2678

PRESERVATION OF FOODSTUFFS BY IONISING BETA- AND GAMMA-RAYS. J. Kuprianoff. Translated by N. Willis from Z. Lebensm.-Untersuch. u. -Forsch. 100, 275-303(1955). 35p.

An evaluation was made of the effectiveness of radiation exposure for the preservation of rapidly perishable foodstuffs. The bactericidal action of ultra-violet radiation, β particles, x radiation, and γ radiation are reviewed. Other factors considered are the technical feasibility of employing radiation procedures on an industrial scale, economic aspects of radiation procedures, effects of radiation exposure on the quality of the foodstuffs, and sanitary procedures associated with radiation exposure. (69 references.) (C.H.)

838

EFFECTS OF GRADED DOSES OF WHOLE-BODY X-IRRADIATION ON MAST CELLS IN THE RAT MESENTERY. F. P. Conte, G. S. Melville, Jr., and A. C. Upton (Oak Ridge National Lab., Tenn.). Am. J. Physiol. 187, 160-2(1956) Oct.

839

CHANGES IN SERUM ALBUMIN DURING IRRADIATION BY γ RAYS (WITHIN THE ORGANISM AND OUTSIDE). Ya. A. Epshtein and E. A. Zabozlaeva (Stalinablad State Med. Inst.). Biokhimiya 21, 499-502(1956) July-Aug. (In Russian)

Concentrations of Fe^{59} in the liver and other organs of dogs produced intensive emissions of γ rays and less intensive β rays. Structure changes were observed in serum albumin similar to the radioinduced changes taking place in albumins outside of organisms. (R.V.J.)

840

LYMPHOID TUMOR INCIDENCE IN MICE TREATED WITH ESTROGEN AND X-RADIATION. Paul Toch, Barbara B. Hirsch, Mary B. Brown, C. Susan Nagareda, and Henry S. Kaplan (Stanford Univ., School of Medicine, San Francisco, Calif.). Cancer Research 16, 890-3(1956) Oct.

841

ON THE ORIGIN AND MODE OF ACCUMULATION OF THE HEMOLYTIC FACTOR OBSERVED IN THE LIVER OF X-

RAYED RATS. Yu. B. Kudryashov. Doklady Akad. Nauk S.S.S.R. 109, 515-18(1956) July 21. (In Russian)

842

THE BASAL METABOLISM OF RATS FOLLOWING THE INJECTION OF RADIOACTIVE IODIDE. C. L. Gemmill, K. R. Crispell, and K. M. Browning (Univ. of Virginia, Charlottesville, Va. School of Medicine). Endocrinology 59, 522-5(1956) Nov.

Large doses of radioactive iodide were given to rats. Their basal metabolism was followed before and after this injection. For a period of several months following the injection cyclic changes were noted in their metabolic activity. These changes are interpreted as attempts on the part of the thyroid gland to recover. The final value of basal metabolism following radioactive iodide removal of the thyroid gland was comparable to the values obtained following surgical removal. For the testing of compounds for metabolic activity, rats may be used with their thyroid glands removed by radioactive iodide or by surgery interchangeably. (auth)

843

THE EFFECT OF X-IRRADIATION ON THE LENGTH OF THE MITOTIC CYCLE IN VICIA FABA ROOTS. Shirley Hornsey (Medical Research Council, Experimental Radiopathology Research Unit, Hammersmith Hosp., London, England). Experimental Cell Research 11, 340-5(1956) Aug.

844

THE RELATIVE CONSTANCY OF THE X-RAY-INDUCED MUTATION FREQUENCY OF DROSOPHILA MELANOGASTER SPERM IN INSEMINATED FEMALES. S. Abrahamson and J. D. Telfer (Indiana Univ., Bloomington). Genetics 41, 677-84(1956) Sept.

845

BEHAVIOR OF NUCLEI AT CONJUGATION IN PARAMECIUM AURELIA. II. THE EFFECTS OF X-RAYS ON DIPLOID AND HAPLOID CLONES, WITH A DISCUSSION OF DOMINANT LETHALS. R. F. Kimball and Nenita Gaither (Oak Ridge National Lab., Tenn.). Genetics 41, 715-28(1956) Sept.

846

LONGEVITY AND CAUSES OF DEATH FROM IRRADIATION IN PHYSICIANS. Shields Warren (New England Deaconess Hospital, Boston). J. Am. Med. Assoc. 162, 464-8(1956) Sept. 29.

In a study of the deaths of 82,441 physicians reported in the period 1930-1954 inclusive, it was found that radiologists die on the average 5.2 years earlier than do other physicians. The nonradiology specialists known to be exposed somewhat to radiation also show definite shortening of life but less than that of radiologists. It may be concluded that exposure to ionizing radiation is the predisposing factor in this shortening of life. The degree of precaution against exposure to ionizing radiation employed by some radiologists up to the present time has not been adequate to protect them from deleterious effects. The present standards for protection appear adequate, but more determined effort should be made to live up to them. (auth)

847

LETHAL EFFECTS OF GAMMA RADIATION UPON SEGMENTS OF A NATURAL MICROBIAL POPULATION. R. J. Davis, V. L. Sheldon, and S. I. Auerbach (Health Physics Div., Oak Ridge National Lab., Oak Ridge, Tenn.). J. of Bacteriol. 72, 505-10(1956) Oct.

848

ON THE SPECIFIC BIOLOGICAL EFFECTS OF IONIZING RADIATION. I. F. Kovalev (Filatov Ukraine Research Inst. of Ocular Sickness and Tissue Therapy). Med. Radiol. 1, No. 4, 7-14(1956) July-Aug. (In Russian)

849

EFFECTS OF X RAYS ON THE REGENERATION OF MUSCULAR TISSUE. T. N. Tuzhilkova (Pavlov, Leningrad Med. Inst.). Med. Radiol. 1, No. 4, 14-21(1956) July-Aug. (In Russian)

850

EFFECTS OF THE AGE AND THE DOSE OF EXPOSURE ON THE SENSITIVITY OF RATS TO X RADIATION. V. V. Kholin (Kirov Inst. of Medical Radiology). Med. Radiol. 1, No. 4, 22-5(1956) July-Aug. (In Russian)

851

REACTIONS OF TEMPERATURE CONTROL CENTERS IN RABBITS VACCINATED BY PYROGENIC ORGANISMS AFTER TOTAL-BODY EXPOSURE TO X RADIATION. N. A. Volokhova (Inst. of Experimental Medicine). Med. Radiol. 1, No. 4, 25-30(1956) July-Aug. (In Russian)

852

EFFECTS OF X RADIATION ON INDUCTION OF LOCALIZED INFECTIONS. B. G. Avetikyan and A. G. Artemova (Inst. of Experimental Medicine). Med. Radiol. 1, No. 4, 35-41(1956) July-Aug. (In Russian)

853

BLOOD REACTIONS IN RABBITS IN THE EARLY STAGES OF PENETRATING RADIATION. M. F. Aleksandrova. Med. Radiol. 1, No. 4, 47-52(1956) July-Aug. (In Russian)

854

ON THE FACTORS INDUCING HEMORRHAGES IN GROWING ANIMALS EXPOSED TO TOTAL-BODY X IRRADIATION. T. D. Mirimova (Inst. of Pediatrics, Acad. of Medical Science). Med. Radiol. 1, No. 4, 56-61(1956) July-Aug. (In Russian)

855

INFLUENCE OF GAMMA IRRADIATION ON THE BREEDING AFFINITIES OF LOLIUM PERENNE AND FESTUCA PRATENSIS. J. D. H. Reusch (Univ. Coll. of Wales, Aberystwyth). Nature 178, 929-30(1956) Oct. 27.

Results are reported from an investigation into the nature of the differentiation and the barriers to successful hydridization between L. perenne and F. pratensis. Results are tabulated on the effect of pollen irradiation a various dose levels of γ radiation on seedset and germination in crosses between the two plants. (C.H.)

856

THE EFFECT OF X-IRRADIATION OF THE OVIDUCT ON EGG PRODUCTION AND EGG QUALITY IN THE FOWL. Arthur H. Smith, T. J. Hage, L. M. Julian, and D. M. Redmond (Univ. of California, Davis). Poultry Sci. 35, 539-45(1956) May.

857

THE INFLUENCE OF STRAIN ON ACUTE X-RAY LETHALITY IN THE MOUSE. I. LD_{50} AND DEATH RATE STUDIES. Henry I. Kohn and Robert F. Kallman (Univ. of California School of Medicine, San Francisco). Radiation Research 5, 309-17(1956) Oct.

858

EFFECT OF HEAD X-IRRADIATION IN RABBITS ON AORTIC BLOOD PRESSURE, BRAIN WATER CONTENT, AND CEREBRAL HISTOLOGY. Herbert B. Gerstner, Phillips M. Brooks, F. Stephen Vogel, and Sidney A. Smith (U.S.A.F. School of Aviation Medicine, Randolph Field, Tex.). Radiation Research 5, 318-31(1956) Oct.

859

ORAL RADIATION DEATH. Henry Quastler, Mildred K. Austin, and Morton Miller (Univ. of Illinois and Carle Foundation, Urbana, Ill.). Radiation Research 5, 338-53(1956) Oct.

860
EFFECTS OF ROENTGEN IRRADIATION ON THE TUMOR BED. II. THE INHIBITING ACTION OF DIFFERENT DOSE LEVELS OF LOCAL PRETRANSPLANTATION ROENTGEN IRRADIATION ON THE GROWTH OF MOUSE MAMMARY CARCINOMA. H. Vermund, K. W. Stenstrom, D. G. Mosser, and E. A. Johnson (Univ. of Minnesota Medical School, Minneapolis). Radiation Research 5, 354-64(1956) Oct.

861
A STUDY OF FACTORS AFFECTING X-RAY-INDUCED CHROMOSOME ABERRATIONS IN THE MICROSPORES OF TRADESCANTIA PALUDOSA. II. THE OXYGEN EFFECT. Robert H. Fetner (Emory Univ., Atlanta, Ga.). Radiation Research 5, 365-71(1956) Oct.

862
MUTAGENIC ACTIONS OF COLD AND X-RAYS IN STREPTOMYCES. Howard B. Newcombe (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Radiation Research 5, 382-9(1956) Oct.

863
THE EFFECTS OF X-RAYS ON THE GROWTH OF SPINAL GANGLIA FROM 6- AND 12-DAY CHICK EMBRYOS IN TISSUE CULTURE. Irene Plactere Goldring (New York Univ., N. Y. and Brookhaven National Lab., Upton N. Y.). Radiation Research 5, 390-403(1956) Oct.

864
THE EFFECT OF MASSIVE DOSES OF NEUTRONS ON THE MEDIAN SURVIVAL TIME OF MICE. Samuel M. Rothermel, Kent T. Woodward, and John B. Storer (Los Alamos Scientific Lab., N. Mex.). Radiation Research 5, 433-40(1956) Oct.

865
OBSERVATIONS ON GASTROINTESTINAL FUNCTION AFTER X-RAY AND THERMAL COLUMN EXPOSURES. I EFFECT ON THE PROGRESS OF BARIUM MEAL, BODY WEIGHT, AND SURVIVAL. Kent T. Woodward and Samuel M. Rothermel (Los Alamos Scientific Lab., N. Mex.). Radiation Research 5, 441-9(1956) Oct.

866
STUDIES WITH TRANSPLANTABLE AK_4 MOUSE LEUKEMIA. I. SUSCEPTIBILITY OF SIX HETEROLOGOUS STRAINS OF MICE AFTER X-IRRADIATION. Irene U. Boone (Los Alamos Scientific Lab., N. Mex.). Radiation Research 5, 450-8(1956) Oct.

867
STUDIES WITH TRANSPLANTABLE AK_4 MOUSE LEUKEMIA. II. RELATIVE BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS AS COMPARED TO X-RAYS. Irene U. Boone, Betty S. Rogers, and Verda G. Strang (Los Alamos Scientific Lab., N. Mex.). Radiation Research 5, 459-65(1956) Oct.

868
THE RELATIVE BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS AND OF THE HEAVY PARTICLES FROM THE B^{10} (n,α) Li^7 REACTION FOR ACUTE EFFECTS IN THE MOUSE. V. P. Bond, O. D. Easterday, E. E. Stickley, and J. S. Robertson (Brookhaven National Lab., Upton, N. Y.). Radiology 67, 650-64(1956) Nov.

Single whole-body doses of thermal neutron radiation were delivered by the Brookhaven reactor to female CF1 mice injected intravenously five minutes previously with boron in the form of borax. The biological endpoint studied was the degree of spleen and thymus weight depression when the animals are sacrificed three-and-one-half days after exposure. The rem dose rates from slow neutron irradiation and from the heavy particles from slow neutron capture by boron (alpha particle and recoil lithium nucleus) were found to be completely additive. The average rep dose from thermal neutrons alone and from boron capture was calculated, assuming the mouse to be a thin foil, from the estimated tissue boron content, the slow neutron capture cross section for boron, the measured slow neutron flux at the proximal skin surface, and the energy release per neutron capture. The effectiveness of thermal neutrons alone, relative to Co^{60} gamma radiation (apparent RBE) was calculated to be 3.8. The apparent RBE of the heavy particles from slow neutron capture by boron was found to be approximately 1.6. This value was increased to 2.5 if the energy liberated by the alpha particle only was considered in the rep determination. (auth)

869
RELATIVE BIOLOGICAL EFFECTIVENESS OF INTERNAL EMITTERS. Miriam P. Finkel (Argonne National Lab., Lemont, Ill.). Radiology 67, 665-72(1956) Nov.

870
THE RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST-NEUTRON AND X-RADIATION. SURVIVAL AND CATARACT STUDIES OF SWISS MICE. E. F. Riley, T. C. Evans, R. B. Rhody, P. J. Leinfelder, and R. D. Richards (State Univ. of Iowa, Iowa City). Radiology 67, 673-85(1956) Nov.

871
THE RELATIVE BIOLOGICAL EFFECTIVENESS OF NEUTRONS, X-RAYS, AND GAMMA RAYS FOR THE PRODUCTION OF LENS OPACITIES: OBSERVATIONS ON MICE, RATS, GUINEA-PIGS, AND RABBITS. A. C. Upton, K. W. Christenberry, G. S. Melville, J. Furth, and G. S. Hurst (Oak Ridge National Lab., Tenn.). Radiology 67, 686-96 (1956) Nov.

For the production of cataracts in mice, rats, and guinea-pigs, cyclotron neutrons of 1 to 2 Mev mean effective energy, administered at high intensity, were two to four times as effective as 250-kvp x rays and three to four times as effective as 1.2-Mev gamma rays; fission neutrons from an experimental nuclear detonation and thermal neutrons had a similar cataractogenic effectiveness in mice. The radiosensitivity of the lens varied appreciably with species; the mouse, rat, guinea-pig, and rabbit exhibiting decreasing sensitivity in the order listed, all being presumably more sensitive than man. With fractionation of neutron or gamma irradiation, there appeared to be only slight, if any, reduction in dose effectiveness at low dose levels in mice. The RBE of fast neutrons of 2 to 3 Mev mean energy (Po-B) administered at relatively low intensities was approximately 9 for induction of mild opacities in mice and appeared to be greater than 9 for the production of threshold lens damage, the relative cataractogenic effectiveness of these and of the other fast neutrons varying inversely with the dose and with the severity of lens injury. (auth)

872
THE EFFECTS OF CONVENTIONAL AND HIGH-ENERGY X-RAYS AND ELECTRONS IN FRACTIONATED DOSAGE ON RATS. Walter S. Moos, John B. Fuller, Walter J. Henderson, and Roger A. Harvey (Univ. of Illinois Coll. of Medicine, Chicago). Radiology 67, 697-703(1956) Nov.

873
CURRENT STATUS OF INSECT CONTROL BY RADIATION. Charles C. Hassett (Army Chemical Center, Md.). Science 124, 1011-12(1956) Nov. 23

Radiation exposure is considered as a safe, nondestructive means of ridding many stored products of insect pests. Radiation sources and the cost of controlling insect pests by exposure to radiation are discussed. (C.H.)

874
AGE, GROWTH, AND THE LD_{50} OF X-RAYS. Henry I. Kohn

and Robert F. Kallman (Univ. of California School of Medicine, San Francisco). Science 124, 1078(1956) Nov. 30.

875

PROBLEMS OF RADIATION GENETICS. N. P. Dubinin. Vestnik Akad. Nauk S.S.S.R. 26, No. 8, 22-33(1956) Aug. (In Russian)

A general review is presented of recent experiments in genetics. Mutant and hereditary effects of the increase in natural radiation and that released by atomic and hydrogen tests were analyzed. Achievements and the possibilities of applying radiation in the induction of selective plant mutations are discussed. (R.V.J.)

Refer also to abstract 1379.

RADIATION HAZARDS AND PROTECTION

876 AF-SAM-56-65

School of Aviation Medicine, Randolph AFB, Texas. SURVIVAL OF ALTITUDE-ACCLIMATIZED RATS FOLLOWING 800 R WHOLE-BODY X-IRRADIATION. Eugene B. Konecci, Dominic Criscuolo, and M. B. Danford. Jan. 13, 1956. 5p.

This study indicates that 6-month altitude acclimatized rats are in a better physiologic state to withstand an 800 radiation exposure than are otherwise comparable ground level controls. Only 3 of 25 ground level controls—as against 16 of 17 altitude-acclimatized animals—survived the 800 r dose. After irradiation, the acclimatized animals were returned to 18,000 feet. Although significant decreases in weight and in hematocrit were observed in the acclimatized animals, by the 19th day following the initial irradiation they had returned to approximately their pre-irradiation levels. An additional dose of 650 r on the 31st day killed all survivors; the 3 controls had died by the 3d day and the 16 acclimatized rats by the 12th day. (auth)

877 HW-40105

Hanford Atomic Products Operation, Richland, Wash. A REVIEW OF THE MPC'S FOR NATURAL THORIUM. J. W. Healy. Nov. 21, 1955. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Since the chemical toxicity of Th is low by any route of administration, the radiation effects will limit the permissible levels. Data available on thorotrast administrations give little information on the hazards of other methods of exposure since the metabolism of thoratrast is different from that of thorium accumulated by ingestion or inhalation. A review of the animal data indicates significant movement of thorium fluoride from the rat lung to the bone. Lung accumulation in the rat and dog resulted from ThO_2 exposures at the rate of 2 to 4% of that inhaled for ~0.8 micron particles with little change in the over-all retention for period up to nine months exposure. The body deposition of thorium from intramuscular or oral administration is mostly in bone indicating bone as the critical organ for the more probable routes of accumulation. Maximum permissible limits become 0.01 μc in the body for soluble compounds or 0.002 μc in the lung for insoluble compounds; 5×10^{-7} μc/cc for water; and 3 10^{-13} μc/cc for air. In order to provide consistency with present recommendations, the computation of these limits, with the exception of the air value, was based on the same assumptions as these made by the International Subcommittee on Permissible Dose from Internal Emitters. Limits for the key daughter products which may occur in quantities in excess of the radioactive equilibrium amounts in any sample are derived. A review of excretion data for thorium indicates that it is too limited at this time to permit valid estimation of body burden. (auth)

878 NYO-4656

New York Operations Office. Health and Safety Lab., AEC. OPERATION TROLL. Preliminary Report. John H. Harley, ed. Mar. 1956. 41p. $0.30(OTS).

Operation Troll was a joint undertaking of the AEC and ONR to evaluate residual radioactivity in the Pacific Ocean a year after the Pacific nuclear tests held in the spring of 1954. Measurements were made over a course of 17,419 miles lasting from February 25 to May 3, 1955. Widespread low-level activity was found in sea water, plankton, and fish samples, but none of the levels was high enough to cause concern as a possible hazard. (auth)

879

EXPERIMENTAL AND CLINICAL RESEARCH ON THE RADIOPROTECTIVE ACTION OF CYSTEAMINE AND CYSTAMINE. I. EXPERIMENTAL RESEARCH ON UNICELLULAR ORGANISMS. G. Baldini and L. Ferri (Univ. of Pavia, Italy). Brit. J. Radiol. 29, 623-4(1956) Nov.

880

THE DANGERS FROM ROENTGENOLOGICAL DIAGNOSTIC EXAMINATIONS. Z. M. Bacq. J. belge radiol. 39, No. 5, 685-95(1956). (In French)

The slow but inevitable increase of the basic radioactivity of the earth owing to the advent and development of atomic energy, our ignorance of the continuous irradiation level which might increase sensibly the frequency of mutations in man, the fact that from the genetic point of view all doses are additive, the certainty that the vast majority of these mutations are detrimental and that therefore a slow genetic degeneration of mankind, especially in the so called civilized countries, is to be feared. The author agrees with J. H. Müller when he declares that it is the duty of all physicians and radiologists to limit to a strict minimum the doses of radiations during roentgenological procedures in all persons who might still be expected to have children. Unnecessary or unnecessarily repeated investigations, and long exposure time in x-ray diagnostic procedures are to be avoided. If not imperatively required diagnostic radiological investigations and roentgentherapic irradiation of the pelvic region, especially in pregnant women and of the testicles in young men should be refused. Precautions should be taken to assure that dose levels are reduced to a minimum. Chemical protection will eventually reduce the danger of small doses of x-rays. Considering the unquestionable value of a favorable genetic capital for mankind, it is our duty to preserve it by all means. (auth)

881

RESTORATION FROM AN X-RAY INDUCED BLOCK IN DEOXYRIBONUCLEIC ACID SYNTHESIS IN ESCHERICHIA COLI. C. O. Doudney (Pennsylvania Univ., Philadelphia. School of Medicine). J. of Bacteriol. 72, 488-93(1956) Oct.

882

ON PROPHYLACTIC USES OF SULFUR CONTAINING COMPOUNDS IN RADIATION SICKNESS. L. F. Semenov and E. A. Prokudina (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, No. 4, 70-5(1956) July-Aug. (In Russian)

883

ROLE OF OXYGEN IN MODIFYING THE RADIOSENSITIVITY OF E. COLI B. Tikvah Alper and P. Howard-Flanders (Hammersmith Hospital, London). Nature 178, 978-9(1956) Nov. 3.

884

RADIOSTRONTIUM FALLOUT FROM CONTINUING NUCLEAR TESTS. Charles I. Campbell. Science 124, 894 (1956) Nov. 2.

Published data on the fall-out of radiostrontium from nuclear tests are reviewed. Assuming a 10-year storage time and a continuing test rate about twice that previously

estimated, it is calculated that the Sr^{90} accumulated on the ground after about 35 years would be 80 mc/mi^2. This would correspond to about 0.14 MPC units in the soil. (C.H.)

885
IMPLANTATION OF NORMAL BLOOD-FORMING TISSUE IN RADIATED GENETICALLY ANEMIC HOSTS. Elizabeth S. Russell, Lois Jean Smith, and Fay A. Lawson (Roscoe B. Jackson Memorial Lab., Bar Harbor, Maine). Science 124, 1076-7(1956) Nov. 30.

RADIATION SICKNESS

886
SPECIAL PROPHYLACTIC MEASURES AGAINST BACTERIAL TOXINS DURING ACUTE RADIATION SICKNESS. P. N. Kiselev and E. V. Karpova (Central Research Roentgen-Radiological Inst.). Med. Radiol. 1, No. 4, 31-5(1956) July-Aug. (In Russian)

887
MORPHOLOGICAL CHARACTERISTICS OF RADIATION SICKNESS INDUCED BY BEAMS FROM 10 MEV BETATRON. I. V. Toroptsev and N. V. Sokolova (Tomsk Medical Inst.). Med. Radiol. 1, No 4, 41-7(1956) July-Aug. (In Russian)

888
ON THE CHANGES OF BLOOD PLATELETS DURING AN ACUTE RADIATION SICKNESS. A. S. Petrova. Med. Radiol. No. 4, 1, 52-6(1956) July-Aug. (In Russian)

889
SOME DATA ON THE USES OF TANNIC ACID IN RADIATION SICKNESS THERAPY. Yu. G. Grigor'ev. Med. Radiol. 1, No. 4, 67-9(1956) July-Aug. (In Russian)

RADIOGRAPHY

890
A GAMMA-RADIOGRAPH. J. E. Roberts (Middlesex Hospital, London). Brit. J. Radiol. 29, 629(1956) Nov.

RADIOTHERAPY

891
RADIOBISMUTH. J. Th. van der Werff. Madicamundi 2, No. 2, 83-8(1956).

Application of radiobismuth in the therapy of lymphatic leukemia, Brill's disease, Hodgkin's disease, lymphosarcoma, and reticulocyte sarcoma is discussed. The physical, physiological, and technical details that play a part in the application of radiobismuth are reviewed. (C.H.)

TOXICOLOGY STUDIES

892 AERE-HP/M-110
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AIR SAMPLING WITH THE ANNULAR IMPACTOR. D. C. Stevens. Aug. 28, 1956. 17p.

The annular impactor is a selective air sampling device. It has been found to have a high collection efficiency (~90%) for the dust particles produced in the course of operations of Pu laboratories and low efficiency (~5%) for the natural radon decay products. It therefore enables samples of airborne Pu dust to be counted without the delay necessary with filter paper samples for the decay of natural radon daughter products. Operating recommendations are given. (auth)

893 ANL-5584
Argonne National Lab., Lemont, Ill.
THERAPY OF RADIOELEMENT POISONING. TRANSCRIPTION OF A MEETING ON EXPERIMENTAL AND CLINICAL APPROACHES TO THE TREATMENT OF POISONING BY RADIOACTIVE SUBSTANCES, HELD OCTOBER 20 AND 21, 1955. Marcia White Rosenthal, ed. Aug. 1956. 181p. Contract W-31-109-eng-38. $1.00 (OTS).

The purpose of this conference was the discussion of available material, both experimental and clinical, on the treatment of internally deposited radioelements. Treatment was considered to involve removal of deposited radioisotopes or the minimization of their deposition in critical organs. Data are presented on the absorption, tissue distribution, excretion, and treatment after absorption of Am^{241}, Am^{242}, Ca^{45}, Cu^{242}, La^{140}, P^{32}, Pu, Sr^{85}, Sr^{90}, Th^{227}, Y^{90}, and miscellaneous fission products from fallout and other sources. The effectiveness of BAL, EDTA, Zr, and miscellaneous chelating agents in the removal of deposited radioelements, and the relationship of Ca meta metabolism to the deposition of metallic ions in bone are discussed. (C.H.)

894 UR-468
Rochester, N. Y. Univ. Atomic Energy Project.
CHRONIC MERCURY POISONING: AN EVALUATION OF OUR PRESENT KNOWLEDGE. Aser Rothstein. Nov. 5, 1956. 7p. Contract W-7401-eng-49. $1.80(ph OTS); $1.80(mf OTS).

895
A STUDY OF THE EFFECTS ON THE LUNG OF INDUSTRIAL EXPOSURE TO ZIRCONIUM DUSTS. C. E. Reed (Corvallis Clinic and the U. S. Bureau of Mines, Albany, Oreg.). Arch. Ind. Health 13, 578-80(1956) June.

TRACER APPLICATIONS

896 AECU-3128
Oregon. Univ., Portland. Medical School.
MEASUREMENT OF RESPIRATORY $C^{14}O_2$ ACTIVITIES. John T. Van Bruggen and Tyra T. Hutchens. 1955. 15p. Contract AT(45-1)-225. $3.30(ph OTS); $2.40(mf OTS).

An apparatus is described which was constructed for the measurement of respiratory $C^{14}O_2$ activities of laboratory animals. The apparatus consists of a small metabolism cage and counting equipment. The air stream containing $C^{14}O_2$ is brought past the window of a thin end window G-M tube contained in a lead shield. Activity detected by the tube is automatically recorded on the moving paper strip of a recorder. Radioassay of the gas is thus made without interference with the gas stream or without adsorption of the CO_2. (C.H.)

897 UCLA-380
California. Univ., Los Angeles. Atomic Energy Project.
THE RELEASE OF Sr^{90} AND Cs^{137} FROM VINA LOAM UPON PROLONGED CROPPING. H. Nishita, A. J. Steen, and K. H. Larson. Nov. 6, 1956. 32p. Contract AT-04-1-GEN-12. $0.40(OTS).

The uptake of Sr^{90}, stable Sr, Ca, Cs^{137} and K by Ladino clover from contaminated Vina loam was studied as a function of intensive, prolonged cropping and with regard to exchangeable and nonexchangeable forms of these ions. Both pot and flat culture methods were used. Data are tabulated. (auth)

898 UCRL-3516
California. Univ., Berkeley. Radiation Lab.
STUDIES ON ERYTHROPOIESIS AS A FUNCTION OF AGE IN THE NORMAL MALE RAT (thesis). Joseph Francis

Garcia. Sept. 6, 1956. 57p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

899
SOME QUANTITATIVE AND QUALITATIVE ASPECTS OF I^{131} METABOLISM IN TURTLES. C. J. Shellabarger, Aubrey Gorbman, Frank C. Schatzlein, and D. McGill (Brookhaven National Lab., Upton, N. Y.; Barnard Coll., New York; and Columbia Univ., New York). Endocrinology 59, 331-9(1956) Sept.

900
NOTES AND COMMENTS. FURTHER OBSERVATIONS ON THE I^{131} METABOLISM OF PREFROZEN THYROID SLICES. S. W. Mayer, B. W. Dimick, and F. H. Kelly (Radioisotope Research Unit, Veterans Administration Hosp., Long Beach, Calif.). Endocrinology 59, 586-90 (1956) Nov.

901
UPTAKE OF P^{32} INTO VARIOUS PHOSPHORUS-CONTAINING FRACTIONS IN THE BRAIN OF NORMAL, HYPOPHYSECTOMIZED AND ACTH-TREATED HYPOPHYSECTOMIZED RATS. J. J. Kocsis (Chicago Univ., Chicago, Ill. Dept. of Pharmacology). Endocrinology 59, 591-3 (1956) Nov.

902
A RADIOIRON STUDY TECHNIQUE FOR THE DIFFERENTIAL DIAGNOSIS OF HAEMATOLOGICAL DISORDERS. W. Horst and H. Villanueva-Meyer (University Hospital, Hamburg-Eppendorf). Medicamundi 2, No. 2, 70-82(1956).

The literature on the dynamics of iron metabolism is reviewed. The iron turnover of 13 healthy controls and 58 patients with various diseases, mainly hematological, was examined with Fe^{59}. Techniques are described and findings are tabulated. (C.H.)

WASTE DISPOSAL

903
RADIOACTIVE WASTE AND HEALTH PROTECTION PROBLEMS. A. N. Mareĭ. Med. Radiol. 1, No. 4, 3-7(1956) July-Aug. (In Russian)

CHEMISTRY

904 AECU-3300
Syracuse Univ., N. Y. Research Inst.
DETERMINATION OF PVT RELATIONSHIPS AND HEAT CAPACITY OF STEAM–OXYGEN MIXTURES. Final Report. James A. Luker and Thomas Gniewek. Aug. 2, 1955. 34p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-558F). $6.30(ph OTS); $3.00(mf OTS).

The saturation composition of the steam–oxygen–liquid water system at 300°C and 2000 psia was determined. The PVT properties of the above mixture were investigated in the superheated region, 1100 to 2700 psia at 550 to 950°F. It was concluded that the PVT data for steam–oxygen systems may be estimated by assuming Dalton's Law and utilizing the PVT data for the pure constituents. (W.L.H.)

905 BMI-1138
Battelle Memorial Inst., Columbus, Ohio.
IGNITION REACTIONS IN THE HYDROGEN–OXYGEN–WATER SYSTEM AT ELEVATED TEMPERATURES. Elmer F. Stephan, Nathan S. Hatfield, Robert S. Peoples, and H. A. Pray. Oct. 2, 1956. 62p. Contract W-7405-eng-92. $0.40(OTS).

Ignition-reaction limits, defined here as the lowest partial pressure of the reactive gases, hydrogen and oxygen, in saturated water vapor which will produce a reaction upon ignition at a particular temperature, were established in a 1.5-in.-diameter autoclave at temperatures up to 550°F and gas partial pressures up to 200 psia. An induced spark was used for ignition. Tests in a 3.0-in.-diameter autoclave with the same limiting conditions of temperature and pressure showed no definite reaction limits. The data indicate that the larger vessels produce lower limits. Hot-wire ignition instead of spark ignition also lowers the reaction limit. Dilution of the mixture with argon or nitrogen raises the limit, but helium lowers the limit through part of the temperature range. Peak reaction pressures were measured under a variety of conditions. (auth)

906 MCC-1023-TR-199
Ohio State Univ. Research Foundation, Columbus.
THE VAPOR–LIQUID EQUILIBRIUM FOR THE DIBORANE–ETHYL ETHER SYSTEM. George E. MacWood and Leo J. Paridon. Mar. 1956. 16p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The satisfactory agreement between the calculated and experimental curves indicates that, with the aid of the K-values, equilibrium diagrams for this system may be calculated with sufficient accuracy in the temperature range 200 to 300°K and the pressure range 15 to 200 psi. (auth)

907 MCC-1023-TR-226
Colorado. Univ., Boulder. Graduate School.
CHEMISTRY OF ALKYLBOROXINES (thesis). John Clifford Perrine. June 1956. 111p. For [Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Butyldimethylborane was prepared and identified by B analysis, molecular weight determination, and by B and N analyses of its pyridine adduct. A new method for synthesizing methylaluminum is included. The synthesis of tributenylboroxine from tributylboroxine and Cl_2 is discussed. Triisobutylboroxine was prepared and some of its physical properties determined. Tributylboroxine was found to react with H_2O to form butane. Triethylboroxine was isolated as a pyrolysis product of tributylboroxine. It was found that an exchange of B atoms occurs between BBr_3 and trimethylborane. Infrared spectra are included for the following compounds; tributylboroxine, triisobutylboroxine, butyldichloroborane, dibutylmethylborane, the pyridine adduct of trimethylborane, and the pyridine adduct of butyldimethylborane. Also the ultraviolet spectra of tributylboroxine and tributylborane are included. (W.L.H.)

908 MCC-1023-TR-229
Ohio State Univ. Research Foundation, Columbus.
HEAT OF VAPORIZATION OF DIBORANE. L. J. Paridon, G. E. MacWood, and Jeh-Heng Hu. Aug. 7, 1956. 8p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The heats of vaporization of diborane have been measured from the normal boiling point to within 4°C of the critical point. Over this range, the heat of vaporization, L_v, is expressed by the equation: $L_v = 546.2(T_c - T)^{0.39}$ where T_c is the critical temperature. (auth)

909 NP-6144
Utah. Univ., Salt Lake City. Inst. for Study of Rate Processes.
TRANSIENTS IN DETONATION. Technical Report No. L. H. J. Allen, M. A. Cook, and D. H. Pack. Apr. 16, 1956. 52p. Project No. 357-239. Contract N7-onr-45107.

Detonation velocity vs. charge length measurements are

described for low density coarse, fine, and coarse-fine TNT, cast TNT, RDX, and low density mixtures of 80/20 ammonium nitrate (AN)-TNT and 90/10 AN-RDX. Interesting dual transitions from low (but constant) to higher (still constant) velocity regimes were observed in TNT for all densities and granulations studied. These sharp velocity discontinuities were similar to the transitions observed previously in tetryl and EDNA except that they were observed near the critical diameter in coarse, low density TNT. Slowly accelerating transients lasting about three charge diameters were observed in the two AN mixtures, and this type superimposed on the discontinuous transition type in coarse-fine mixtures of TNT. The transient of approximately 3d duration is that type predicted by the detonation head model for non-ideal explosives. The sharp transition type is probably associated with the influence of pressure on the composition of the products of detonation and the exothermicity of the detonation reaction. (auth)

910 PRL-5.18

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report No. 6 for April, May and June 1956. June 30, 1956. 82p. Contract AF33(616)-2851.

(For preceding period see PRL-5.17.)

911 UCRL-3489

California. Univ., Berkeley. Radiation Lab.

C- AND N-TERMINAL AMINO ACIDS OF HUMAN SERUM LIPOPROTEINS. Bernard Shore. Aug. 6, 1956. 11p. Contract W-7405-eng-48. $0.15(OTS).

912 AEC-tr-2653

COLLOIDAL THORIUM HYDROXIDE. I. THE FORM AND SIZE OF COLLOIDAL PARTICLES. A. Dobry, S. Guinand, and A. Mathieu-Sicaud. Translated from J. chim. phys. 50, 501-6(1953). 15p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1522.

913 IGRL-T/C-24

SATURATION PRESSURE OVER SOLID NIOBIUM(IV) CHLORIDE. H. Schafer and L. Bayer. Translated by J. Standring from Z. Anorg. u. allgem. Chem. 277, 140-5 (1954). 6p.

The saturation pressure over solid $NbCl_4$ was ascertained by a quenching method. The tetrachloride solid phase is formed directly in the reaction chamber from metallic Nb and $NbCl_5$. During the measurement the $NbCl_5$ pressure was so great that the tetrachloride decomposition to trichloride and pentachloride did not occur. The saturation pressure of solid $NbCl_4$ was given by log $P_{mm} = 12.30 - 6.87 \times 10^3/T$. $NbCl_4$ is already fairly volatile at 300 to 400°C as has already been observed in its preparation. Also in the measurement of its dissociation this volatility was noticeable: $2\ NbCl_4(s) = NbCl_3(s) + NbCl_5(g)$ Log P ($NbCl_5$, mm) = $13.16 - 6.19 \times 10^3/T$ (203 – 313°C). In the determination of the $NbCl_4$ saturation pressure now carried out the tetrachloride dissociation was prevented by the presence of an appreciable regulated pressure of $NbCl_5$. (auth)

914

HYDROLYTIC BEHAVIOR OF METAL IONS. VIII. ULTRACENTRIFUGATION OF BISMUTH(III) IN PERCHLORATE SOLUTION. Robert W. Holmberg, Kurt A. Kraus, and James S. Johnson (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 5506-10(1956) Nov. 5.

Equilibrium ultracentrifugations of $BiOClO_4$ solutions were carried out as a function of acidity, of supporting electrolyte ($NaClO_4$) concentration and of Bi concentration. Over a range of acidity (~ 0.01 to 0.1 M H_3O^+) where Bi is considerably hydrolyzed (hydroxyl number n = ca. 2) a monodisperse hydrolytic polymer of degree of polymerization N = 5 or 6 was found. This polymer appears to be appreciably complexed by perchlorate ions. (auth)

915

THE REACTION OF COBALT(II) BROMIDE WITH LITHIUM BOROHYDRIDE AND LITHIUM ALUMINOHYDRIDE. Albert C. Stewart and George W. Schaeffer (St. Louis Univ.). J. Inorg. and Nuclear Chem. 3, 194-7(1956) Oct.

The reaction of $CoBr_2$ with $LiBH_4$ gives a precipitate containing Co and B in the mole ratio of 1/2 and H_2; with $LiAlH_4$ a similar Co-Al precipitate and H_2 are obtained. These precipitates are black, pyrophoric materials which exhibit chemical behavior typical of the elements. (auth)

916

CHARGE TRANSFER RATES BETWEEN THE ETHYLENEDIAMINETETRA-ACETATE COMPLEXES OF Co(II) AND Co(III), AND OF Fe(II) AND Fe(III). Arthur W. Adamson and Karl S. Vorres (Univ. of Southern California, Los Angeles). J. Inorg. and Nuclear Chem. 3, 206-14(1956) Oct.

The charge transfer process was found to be immeasurably fast for the system $FeY^{-2} — FeY^{-1}$ (Y denoting the ethylenediaminetetra-acetate ligand), and, for the system $CoY^{-2} — CoY^{-1}$, to obey second-order kinetics with a specific rate constant of 0.75/hr/M at 85°C and pH 2. The energy and entropy of activation were found to be 22 kcal/mole and –17 cal/deg. mole, respectively. It is suggested that this difference in lability of seemingly similar systems is explainable primarily in terms of their crystal-field energy-level diagrams and that other charge transfer cases can be correlated similarly. (auth)

917

COMPLEXONES: A BIBLIOGRAPHY OF ANALYTICAL, BIOLOGICAL, AND INDUSTRIAL APPLICATIONS. M. R. Verma and K. J. Therattil (National Physical Lab. of India, New Delhi). J. Sci. Ind. Research (India) 15A, Suppl., 1-41 (1956) Sept.

The name complexones is applied to a group of compounds which are essentially derivatives of iminodiacetic acid. They have the remarkable property of chelating with a large number of inorganic ions, and the conditions under which chelation occurs differ considerably for different ions. References are presented to some of the important papers on the applications of complexones, including their preparation, purification, and estimation. The references are arranged under suitable heads to facilitate easy reference. (572 references.) (C.H.)

918

EFFECTS OF THE COMPOSITION AND CONDITIONS OF PREPARATION ON THE OPERATING PROPERTIES OF Ni–Al BARE CATALYSTS. E. A. Stolyarov and O. M. Todes (Leningrad State Univ. of Applied Chemistry.). Zhur. Fiz. Khim. 30, 23-27(1956) Jan. (In Russian)

Effects of the composition and the conditions of preparation on the structure of Ni–Al alloys and the activity of the bare catalyst prepared from these alloys were investigated. It was found that more homogeneous structures are obtained with 30% Ni alloys fused at 1800°C. Catalysts prepared from such alloys have a minimum amount of Al and an increased activity. Metallographical investigations (alkali etched polished section) were used to determine the quality of the alloy and hydrogenation of styrene to determine the catalytic activity. (R.V.J.)

919

PHYSICO-CHEMICAL STUDY OF THE SYSTEM $H_2O–SO_3$. I. THE VAPOR-LIQUID PHASE OF $H_2O–SO_3$. G. P. Luchinskiĭ. Zhur. Fiz. Khim. 30, 1207-22(1956) June. (In Russian)

Pressures and vapor composition of the system H_2O-SO_3 were measured in the temperature range from 20 to 200°C and at the boiling point. It was found that in the H_2O-SO_3 system the vapors over liquids with less than 85% H_2SO_4 consist of water only, but over the liquids containing over 35% of free SO_3 they consist of SO_3, and over those with 85% H_2SO_4 to 35% of free SO_3 it consists of sulfuric acid with water and SO_3. The system has a single azeotropic point corresponding to minimum vapor, pressure, the position of which changes with the temperature from 98.31 to 98.33% H_2SO_4. The boiling point of the non-aqueous sulfuric acid is 279.6° and of the azeotrope is 338.8°C. (tr-auth)

920

BOUNDARIES OF HOMOGENEITY OF TANTALUM CARBIDE PHASES AND DEPENDENCE OF THERMODYNAMIC AND OTHER PROPERTIES ON THE COMPOSITION AND STRUCTURE OF THE PHASES. V. I. Smirnova and B. F. Ormont. (Karpov Moscow Inst. of Physical-Chemistry). Zhur. Fiz. Khim. 30, 1327-42(1956) June. (In Russian)

Investigations were made of the Ta–C system, the phase homogeneity boundaries (the cubic γ phase TaC_x, x = 0.58 up to 0.92 and possibly up to 1.0; the hexagonal β phase: TaC_x, x = 0.38 to 0.50, and the unit cell dimensions where γ phase: a = 4,420 to 4,466A; β phase: a = 3,101A, c = 4,936 A to a = 3,104 A, C = 4,943 A) were determined (on one and the same sample) as functions of the composition. It was shown that the enthalpy and free energy of formation of TaC as well as the abrasive properties depend strongly upon the phase composition. (tr-auth)

ANALYTICAL PROCEDURES

921 AD-95183

Frankford Arsenal. Pitman-Dunn Labs., Philadelphia.
DETERMINATION OF OXYGEN IN TITANIUM, ZIRCONIUM, CHROMIUM, VANADIUM AND STEELS BY THE BROMINATION–CARBON REDUCTION METHOD. Technical Report. Maurice Codell and George Norwitz. Mar. 9, 1956. 28p. (S-5185).

Improvements have been made in the bromination–carbon reduction method for the determination of O_2 in Ti and Ti alloys. The various factors contributing to the blank were investigated and the blank reduced considerably by purification of the Br_2. The method was applied to the determination of O_2 in Zr, Cr, V, and steels. The method for O_2 in Zr is essentially that used for O_2 in Ti. For the determination of O_2 in Cr and V the sample must be crushed to a powder, mixed well with the graphite and the bromination carried out at 925°C. For V alloys containing Al, the graphite residue must be ignited and the unattacked oxide weighed as Al oxide. For the determination of O_2 in steels, pieces of the steel must be used, drillings not being permissible because of their oxide coating. In determining O_2 in steels, the absorption bulb must be brought to constant weight before the reaction tube is heated, since carbides and O_2 in steel react to form CO when the steel is heated. The method for steels is recommended for samples containing more than 0.05% O_2. (auth)

922 AERE-C/M-283

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE PREPARATION OF PURE ZIRCONIA FOR USE AS A SPECTROGRAPHIC STANDARD. D. L. G. Smith and F. E. Wild. Aug. 1956. 6p.

Pure zirconium oxychloride octahydrate crystals can be prepared by saturating a solution of the crude material with HCl. Depending on the purity of the original material several recrystallizations may be necessary. Zirconia may be prepared from these crystals by dehydration under an infra red lamp followed by ignition at 800°C. (auth)

923 DP-171

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
"VERSENE" TITRATION OF THORIUM AND ALUMINUM. Wilmer R. Cornman. Aug. 1956. 8p. Contract AT(07-2)-1. $0.15(OTS).

A method was developed for the determination of Th and Al in HNO_3 solutions containing small amounts of fluoride ion. Titration with "Versene" (disodium ethylenediaminetetraacetic acid) was employed with Alizarin Red S as an internal indicator. (auth)

924 HW-45513

Hanford Atomic Products Operation, Richland, Wash.
ALTERNATING CURRENT AND SQUARE-WAVE POLAROGRAPHY. Randall E. Hamm. Sept. 11, 1956. Decl. Nov. 9, 1956. 16p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Greater sensitivity and selectivity are achieved using a polarographic technique in which an alternating sine or square-wave potential is superimposed upon the applied d-c potential of the polarographic scan. As little as 0.005 g of U/l can be determined in the presence of 0.05M Fe^{3+}. (T.R.H.)

925 LA-2032

Los Alamos Scientific Lab., N. Mex.
THE GRAVIMETRIC DETERMINATION OF TANTALUM IN URANIUM–TANTALUM ALLOYS. Owen H. Kriege and Ross D. Gardner. Apr. 1956. 20p. Contract W-7405-eng-36. $0.20(OTS).

Two gravimetric methods are described for the quantitative determination of Ta in U–Ta alloys. In the first procedure, the sample is dissolved with HNO_3 and HCl, fumed to dryness with H_2SO_4, taken up with water and treated with H_2SO_3 to precipitate hydrated Ta_2O_5. The precipitate is ignited at 1000°C and weighed as Ta_2O_5. An average recovery of 100.2%, with an average standard deviation of 0.6%, was obtained for 33 determinations on known solutions containing 30 to 45 mg of Ta and 3 to 6 g of U. In the second method, the sample is dissolved with HNO_3 and HF, fumed to dryness with H_2SO_4, taken up with water and treated with cupferron, in a strongly acid solution to precipitate the Ta. Sulfurous acid is added prior to the precipitation with cupferron to reduce any Fe which may be present in the sample. The precipitate is ignited at 1000°C and weighed as Ta_2O_5. An average of 100.3% was found, with an average standard deviation of 0.6%, for 35 determinations on known solutions containing 30 to 45 mg of Ta, 3 to 15 mg of Fe, and 3 to 6 g of U. (auth)

926 LA-2049

Los Alamos Scientific Lab., N. Mex.
THE GRAVIMETRIC DETERMINATION OF NIOBIUM IN URANIUM–NIOBIUM ALLOYS. Owen H. Kriege. May 1956. 14p. Contract W-7405-eng-36. $0.20(OTS).

The determination of Nb in U–Nb alloys is based on the precipitation of hydrated Nb_2O_5 from a H_2SO_3 solution. The sample is dissolved with HCl and H_2O_2, boiled to expel the excess peroxide, and then treated with H_2SO_3. The precipitate is ignited at 800°C and weighed as Nb_2O_5. An average recovery of 100.46%, with an average standard deviation of 0.31%, was obtained for 50 determinations on known solutions containing 30 to 60 mg of Nb and 0.5 to 6.0 g of U. (auth)

927 NYO-642

Pennsylvanis State Coll., University Park.
POLAROGRAPHIC BEHAVIOR OF ORGANIC COMPOUNDS.

V. ANALYSIS OF MIXTURES OF DICHLOROACETIC AND TRICHLOROACETIC ACIDS. Philip J. Elving and Chiang-Siang Tang. May 20, 1950. 12p. Contract AT(30-1)-822, Report No. 1. $3.30(ph OTS); $2.50(mf OTS).

A rapid and simple polarographic method for Cl_3CCOOH and $Cl_2CHCOOH$ in mixtures of chloroacetic acids is described. (T.R.H.)

928 NYO-4617

New York Operations Office. Health and Safety Lab., AEC.

RADIOCHEMICAL DETERMINATION OF STRONTIUM 89 AND STRONTIUM 90. James Fresco, Edward Hardy, and George Welford. Dec. 7, 1954. Decl. May 12, 1955. 49p. $7.80(ph OTS); $3.30(mf OTS).

Developments in the radiochemical determination of Sr^{89} and Sr^{90} are reported. The conditions for isolation of Sr from large samples of bone, soil, vegetation, water, urine, and milk into HNO_3 are described. The analytical procedures for various sample types are given and a method for purification of $Y(NO_3)_3$ is included. (T.R.H.)

929 ORNL-2178

Oak Ridge National Lab., Tenn.

DETERMINATION OF FREE ACID IN SOLUTIONS OF URANYL SULFATE. Oscar Menis, D. L. Manning, and G. Goldstein. Nov. 8, 1956. 16p. Contract W-7405-eng-26. $0.20(OTS).

A method is described for the determination of free acid in solutions of UO_2SO_4 by means of the Sargent-Malmstadt Automatic differential titrator whereby the inflection point of a potentiometric curve is automatically detected and used to turn the buret off. This instrument has the advantage over other automatic titrators in that it does not require graphical interpretation of the end point or a presetting of the end point potential. The interference caused by the hydrolysis of UO_2^{2+} was eliminated by complexing the U with fluoride. The electrode system of Pt–Rh alloy indicator and calomel reference electrodes, used with this instrument, offered an advantage over a glass electrode system when titrating in a HF medium. The application of this instrument offers a rapid and precise method for the determination of 0.1 to 1.0 meq of acid in the presence of 0 to 200 mg of U in a final volume of 50 ml. The coefficient of variation of the method is less than 2%. When more than 200 mg of U is present, however, the coefficient of variation is of the order of 5%. (auth)

930 RMO-2043

International Minerals and Chemical Corp., Chicago.

ANALYTICAL PROCEDURES FOR URANIUM. Maxon T. Esterdahl, John H. Gross, J. B. Adams, and Roger Bart. Feb. 28, 1955. Decl. Oct. 27, 1955. 11p. Contract AT(49-1)-545. (IMCC-2214). $1.80(ph OTS); $1.80(mf OTS).

Fluorimetric, volumetric, and spectrophotometric methods are presented for the determination of U in phosphatic ores and phosphate-bearing solutions. (W.L.H.)

931 WIN-52

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

DETERMINATION OF TRIBUTYL PHOSPHATE. Robert J. Allen and Michael A. DeSesa. Nov. 15, 1956. 27p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

Because of the need for a rapid method of analysis for TBP in kerosene and hexane diluents, and investigation into proposed methods of analysis for TBP was made. As a result of this study, the two indirect methods based on the proportional extraction of HNO_3 or U by solutions of TBP were modified and improved. Also a new, very sensitive, indirect photometric method based on the ultraviolet absorbance of the TBP–uranium complex was developed. In conjunction with an evaluation of the acid saturation method, the successive formation constants for the TBP–nitric acid complexes were determined to be 0.45 for $TBP(HNO_3)$ and 0.039 for $TBP(HNO_3)_2$. (auth)

932 Y-1140

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

ETHYLENEDIAMINETETRAACETATE SEPARATION OF CALCIUM FROM URANIUM FOR FLAME PHOTOMETRIC ANALYSIS. J. H. Stewart, Jr., and R. C. McIlhenny. Aug. 21, 1956. 14p. Contract W-7405-eng-26. $0.20(OTS).

A method is described for the determination of Ca in a U matrix by a rapid and relatively sharp separation of the Ca from the U, followed by a flame photometric measurement of the Ca concentration. The separation is effected by using the strong complex formed between Ca ion and the disodium salt of ethylenediaminetetraacetate (EDTA) ion in a basic solution. A corresponding complex between UO_2^{2+} ion and EDTA does not form in a basic solution. Accuracy and precision are superior to that obtained by spectrographic analysis, and the method is more rapid than the classic permanganate titration method. (auth)

933 TIB/T4499A

THE CHROMATOGRAPHIC SEMI MICRO-ANALYSIS OF GASES. I–III. THEORETICAL AND PRACTICAL BASIS OF THE ANALYSIS. (Chromatographische Halbmikroanalyse von Gase. I–III. Theoretische und Praktische Grundlagen der Analyse). J. Janak. Translated from Collection Czechoslov. Chem. Communs. 19, 684-99(1954). 19p. (AD-92319).

A chromatographic method for separation and quantitative determination of gases is described. The basis for the determination is their characteristic elution volumes (chromatographic spectra). (T.R.H.)

934

FLUOROMETRIC DETERMINATION OF URANIUM. Frederick A. Centanni, Arthur M. Ross, and Michael A. DeSesa (National Lead Co., Inc., Winchester, Mass.). Anal. Chem. 28, 1651-7(1956) Nov.

The fluorometric method of determining uranium has been improved during several years of practical experience, in order to achieve a high degree of accuracy in the rapid, routine processing of a large, daily sample load. A modified Fletcher burner has been designed, on which 20 fluoride fusions are made at one time under reproducible fusion conditions. A fluorometric flux mixture of 2% LiF and 98% NaF is superior to other fluxes in sensitivity, precision, and convenience. The coefficient of variation of the method employing this new flux has been determined to be 0.7%. This constitutes at least a sixfold improvement in precision. The method has been proved to be rapid, accurate, and economical in almost 2 years of use at this laboratory, where U is determined in approximately 3000 samples each month. (auth)

935

DETERMINATION OF BERYLLIUM IN TITANIUM ALLOYS. L. C. Covington and M. J. Miles (Titanium Metals Corp. of America, Henderson, Nev.). Anal. Chem. 28, 1728-30(1956) Nov.

A colorimetric method for determining beryllium in titanium alloys has been developed, using 4-(p-nitrophenylazo) orcinol. The reagent dissolved in 0.1N sodium hydroxide forms a red-brown lake with beryllium in a 0.4N sodium hydroxide solution buffered with borate and citrate. The dye is nearly specific for beryllium. Titanium is held in solution with an excess of peroxide. Other interfering ions are held in solution as chelates of tetrasodium (ethylenedinitrilo) tetraacetate. The method is satisfactory for 0.25 to 1.0% beryllium in titanium alloys. (auth)

936

RADIOCHEMICAL DETERMINATION OF PHOSPHORUS-32.

W. B. Silker (Hanford Atomic Products Operation, Richland, Wash.). Anal. Chem. 28, 1782-3(1956) Nov.

A method for the radiochemical determination of phosphorus-32 in reactor cooling water is based on solvent extraction of phosphorus as molybdophosphoric acid. After sorption of radioarsenic on cupric sulfide and exclusion of radiosilicon by extraction from high acid concentration, radiochemically pure phosphorus-32 is extracted with a 10% solution of 1-butanol in diethyl ether. The method is rapid, accurate, and reproducible; 86.6% of the phosphorus-32 is recovered by a single extraction. (auth)

937

CELL CORRECTIONS IN PRECISION COLORIMETRY. Charles V. Banks, Patrick G. Grimes, and Roman I. Bystroff (Iowa State Coll., Ames). Anal. Chim. Acta 15, 367-72(1956) Oct.

Errors introduced by the non-uniformity of cells limit the practical application of precision colorimetric theory. The methods of correcting for these errors are not readily evident from the theoretical discussions in recent literature. Three methods of correction for variations in cell length and absorbance are presented. (auth)

938

THORIUM COMPLEX OF 2,7-DINITROSO-1,8-DIHYDROXYNAPHTHALENE-3,6-DISULPHONIC ACID. I. DETECTION AND VOLUMETRIC DETERMINATION OF THORIUM. Sachindra Kumar Datta (Darjeeling Government Coll., India). Anal. Chim. Acta 15, 415-20(1956) Nov.

Dinitrosochromotropic acid has been used as a new reagent for the determination of Th. It forms a pinkish-violet Th complex which is highly soluble in water and in which two atoms of Th are associated with three molecules of the reagent. The complex may be precipitated from a concentration solution of Th with an excess of the reagent and the maximum quantity of the Th complex that may be recovered in the solid state is only 51.8% at pH 4.1. The smallest amounts of Th that may be detected with this reagent by spot test on the spot plate and on filter paper are respectively 1.0 μg and 2.5 μg. Thorium has also been successfully determined volumetrically using oxalic acid in the presence of this reagent in the pH range 3-3.9; common metals like Cd, Ba, Ca, Al etc. do not interfere. (auth)

939

THORIUM COMPLEX OF 2,7-DINITROSO-1,8-DIHYDROXYNAPHTHALENE-3,6-DISULPHONIC ACID. II. SPECTROPHOTOMETRIC DETERMINATION OF THORIUM. Sachindra Kumar Datta (Darjeeling Coll., India). Anal. Chim. Acta 15, 421-5(1956) Nov.

Dinitrosochromotropic acid has been used for the spectrophotometric determination of Th. The Th complex of the reagent shows an absorbance maximum at 370 mμ. The color system conforms to Beer's law and is stable for a considerable period. The determination of thorium by this method is accurate and rapid and the reagent is sensitive to 0.03 μg of thorium per ml. The pH range suitable for the determination is from 2.5 to 3.4. A number of ions do not interfere but Zr and Fe are among the ions which exhibit strong interference and should be removed before applying this method. (auth)

940

DETERMINATION OF MICRO-AMOUNTS OF BORON IN URANIUM METAL AND IN URANYL CHLORIDE SOLUTIONS. Louis Silverman and Katherine Trego (North American Aviation, Inc., Canoga Park, Calif.). Anal. Chim. Acta 15, 439-45(1956) Nov.

The direct colorimetric determination of B (curcumin-oxalic acid method) in UO_2Cl_2 solution is possible, without prior removal of U. The interference ascribed to the presence of U lies in the fact that U preferentially combines with the available oxalic acid. If, therefore, suitable excess of oxalic acid is added, the U forms a soluble uranium-oxalate complex which need not be removed. Thus, no preliminary alcohol-distillation is required. Special boron-free spectrophotometric reference solutions are prepared by a rapid hydrochloric acid-volatilization method. Acid-soluble boron, 3 to 50 ppm, is determined in the presence of 100 mg of U. Insoluble B is determined separately after carbonate fusion of the acid-insoluble portion. (auth)

941

COULOMETRIC TITRATION OF IRON, CERIUM AND VANADIUM WITH TITANOUS ION. James J. Lingane and John H. Kennedy (Harvard Univ., Cambridge, Mass.). Anal. Chim. Acta 15, 465-72(1956) Nov.

The current efficiency for the electrogeneration of titanium^{3+} at a platinum cathode in H_2SO_4 and HCl media has been evaluated as a function of generating current density, concentration of titanium^{4+}, and acid concentration. With 6 to 8M H_2SO_4 containing 0.6M titanyl sulfate the generation of titanous ion is 100% efficient up to a current density of 3 milliamp/cm^2. With this medium Fe^{3+}, Ce^{4+}, and V^{4+} and V^{5+} can be titrated coulometrically with errors of about ±0.3% or less. (auth)

942

THE RAPID DETERMINATION OF RADIOACTIVITY DUE TO CAESIUM-137 IN MIXED FISSION PRODUCTS BY ANION EXCHANGE AND GAMMA-RAY SPECTROMETRY. J. L. Woodhead, A. J. Fudge, and E. N. Jenkins (Atomic Energy Research Establishment, Harwell, Berks, England). Analyst 81, 570-7(1956) Oct.

An investigation has been carried out on the use of anion-exchange resins in the hydroxide and carbonate forms as solid precipitants in the analysis of mixed fission-product solutions for Cs^{137}, a De-Acidite FF anion-exchange resin column in the carbonate form being used as the solid precipitant for the removal of other fission-product elements. Cs^{137} is determined by measurement of its Ba^{137} daughter on a gamma scintillation spectrometer. The method compares favorably with a recent procedure for the determination of cesium by gamma spectrometry and with a standard complete radiochemical separation procedure. (auth)

943

A COMPARISON OF TWO METHODS FOR CONVERTING GRAIN COUNTS TO WEIGHT PERCENT COMPOSITION. Richard C. Kellagher and Francis J. Flanagan. J. Sediment. Petrol. 26, 222-7(1956) Sept.

Differences in experimental weight percent composition obtained in a recent study of sampling methods, when compared to the known composition of the original sample, have led to the reassessment of the method of computing weight percent composition from grain counts. The concept of average weight per grain of each mineral was used in place of the frequently used specific gravity factor method. The differences in the results calculated by specific gravity factors and by average weights per grain can be seen to be significant by inspection. Comparison of the mean percentages of the minerals shows that the results obtained using the concept of average weight per grain are the best estimates of the known weight percent composition. (auth)

944

DETERMINATION OF URANIUM CONTENT IN RADIOACTIVE MINERALS BY AUTORADIOGRAPHY. G. V. Umamaheswararao and R. Krishnaswamy (Atomic Energy Establishment, Bombay). Proc. Indian Acad. Sci. 44A, 144-51(1956) Sept.

Nuclear track plates serve as a rapid and cheap tool in the identification and estimation of radioactive minerals in ore specimens, microsections and sand-grains. A method of estimation of the uranium content of the minerals from

photographic density was studied. This method avoids the tedious process of counting large number of tracks recorded in the nuclear emulsion by the radioactive minerals. The effects of uranium content of the mineral specimens, duration of exposure of the plate to the mineral specimens, period of development of the plates and temperature of the developer bath, on photographic density were studied. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

945

THE CRYSTAL STRUCTURES OF THORIUM ANTIMONIDES. Riccardo Ferro (Chemical Inst., Lab. of Physical Chemistry of Genoa Univ., Italy). Acta Cryst. 9, 817-18(1956) Oct.

Powder mixtures of Th and Sb were pressed and closed in vacuum in a silica ampullae and heated to ~ 1000°C. The product obtained was compact, mechanically resistant, and pyrophoric. Examination of the sample indicated the existence of the compounds. ThSb, Th_3Sb_4, and $ThSb_2$. (W.L.H.)

946

THE STRUCTURES OF Cs_2ThCl_6 AND Cs_2UCl_6. Stanley Siegel (Chemistry Div., Argonne National Lab., Lemont, Ill.). Acta Cryst. 9, 827(1956) Oct.

DEUTERIUM AND DEUTERIUM COMPOUNDS

947 TT-623

DIFFERENCES IN THE THERMAL PROPERTIES OF HEAVY AND LIGHT WATER. (Unterschiede Zwischen den Thermisch-kalorischen Eigenschaften des Schweren and Leichten Wassers). A. Eucken. Translated by D. A. Sinclair from Nachr. Akad. Wiss. Göttingen. Math.-physik. Kl., IIa, 1-11(1949). 15p.

948

CALCUALTIONS OF EXPERIMENTAL DATA ON HYDROGEN ISOTOPE EXCHANGE. Ya. M. Varshavskiĭ and V. R. Kalinachenko (Karpov Moscow Inst. of Physical Chemistry). Zhur. Fiz. Khim. 30, 1376-9(1956) June. (In Russian)

General equations have been derived for calculating the distribution coefficients of D from the experimental data. Also, the number of exchangeable and exchanged atoms was determined considering the different exchange capacities of different hydrogen atoms in the molecule and considering the possible deviation of the distribution coefficient from unity. (tr-auth)

FLUORINE AND FLUORINE COMPOUNDS

949

FLUOROCARBON SOLUTIONS AT LOW TEMPERATURES. II. THE LIQUID MIXTURES $C_2H_6-C_2F_6$, $C_2F_6-CHF_3$, $CH_2F_2-CHF_3$, $C_2H_6-CHF_3$ AND $Xe-CHF_3$. N. Thorp and R. L. Scott. (Dept. of Chemistry, Univ. of Calif., Los Angeles, Calif.). J. of Phys. Chem. 60, 1441-3(1956) Oct.

The liquid-liquid binary systems $C_2H_6-C_2F_6$, $C_2F_6-CHF_3$, $CH_2F_2-CHF_3$, $C_2H_6-CHF_3$ and $Xe-CHF_3$ have been studied between 173-193°K. The vapor pressures of $C_2H_6-C_2F_6$, $C_2F_6-CHF_3$, and $CH_2F_2-CHF_3$ mixtures were studied at 176°K. The last system was found to be ideal. Mixtures of $C_2H_6-C_2F_6$ show abnormally large positive deviations from Raoult's law, similar to those found previously in other fluorocarbon-hydrocarbon pairs. Mixtures of C_2F_6 with CHF_3 also show greater positive deviations from ideality than can be explained by the regular solution-solubility parameter equations. Both $C_2H_6-CHF_3$ and $Xe-CHF_3$ form two phases; the consolute temperature is about 186°K. for both systems. These results are also in disagreement with the predictions of the solubility parameter theory, and support the possibility of intermolecular hydrogen bonding in liquid CHF_3. (auth)

950

REACTION HEATS OF ORGANIC HALOGEN COMPOUNDS. VI. THE CATALYTIC HYDROGENATION OF SOME ALKYL FLUORIDES. J. R. Lacher, A. Kianpour, and J. D. Park (Dept. of Chemistry, Univ. of Colorado, Boulder, Colo.). J. of Phys. Chem. 60, 1454-5(1956) Oct.

The heat of hydrogenation of $CH_3CH_2CH_2F$ and CH_3CHFCH_3 at 248° are determined using a previously described apparatus. (T.R.H.)

951

BROMINE PENTAFLUORIDE. FREEZING AND BOILING POINTS, HEAT OF VAPORIZATION AND VAPOR PRESSURE-TEMPERATURE RELATIONS. Max T. Rogers and John L. Speirs (Kedzie Chemical Lab., Michigan State Univ., East Lansing, Mich.). J. of Chem. Phys. 60, 1462-3(1956) Oct.

Previously described methods were used to obtain better values for some physical constants of BrF_5. The freezing point is $-60.5 \pm 0.1°$; boiling point is $40.76 \pm 0.05°$; heat of vaporization is 7.31 kcal./mole; the vapor pressure-temperature relationship is: log p (mm at 0°) = 7.9727 - 1598.2/T. (T.R.H.)

Refer also to abstract 1202.

GRAPHITE

952 AECD-3751

Great Lakes Carbon Corp., Morton Grove, Ill.
[HIGH DENSITY GRAPHITE. Semiannual] Report [for] June through November 1952. L. H. Juel. Decl. June 11, 1956. 33p. Contract AT(11-1)-221. $7.80(ph OTS); $3.30(mf OTS).

953 HW-12780(Rev.)

[Hanford Works, Richland, Wash.]
PURIFICATION OF GRAPHITE. J. M. West. Mar. 21, 1949. Decl. Feb. 9, 1956. 23p. Contract [W-31-109-Eng-52]. $0.35(OTS).

A compilation of data on the purification of graphite is given. Reports, letters, and memoranda since 1947 are abstracted in this description of all the important experiments and developments at the National Carbon Company plant at Morganton, N. C. (T.R.H.)

954 NYO-7553

New York. State Univ. Coll. of Ceramics, Alfred.
GRAPHITIZATION STUDIES. Final Report. John Hay, W. J. Sutton, Yung Tao, and V. D. Frechette. Apr. 1, 1956. 48p. Contract AT(30-1)-1297. $7.80(ph OTS); $3.30(mf OTS).

Using pressures within the range of 20,000 psi to 80,000 psi the bonding of natural and synthetic graphites has been studied. Whereas cold compaction of Ceylon and Canadian graphites at 80,000 psi achieved densities of the order of 2.2 g/cm^3 similar treatment of synthetic graphite failed to develop any bonding. The formation of broken bonds and fresh edges by partial wet oxidation of synthetic graphite with Brodies mixture enable compacts to be produced having a density of 1.9 g/cm^3. Heat treatment of partly wet oxidized graphite compacts to 2600°C in a helium atmosphere resulted in a weight loss of 13% to 14%, but hot pressing in graphite molds yielded compacts having a density of 1.93 g/cm^3. Removal of impurities from natural graphites by digestion with sulfuric and hydrofluoric acids, although more effective than chlorination at 900°C, involved the introduction of sulfur into the graphite. Initially this no doubt existed as a residue com-

pound but subsequent heating to temperatures in excess of 2000°C failed to effect the entire removal of sulfur, which in small amounts has been found to exert a marked effect on the expansion properties of natural graphite when heated. In addition to cold compaction and hot pressing techniques, the possibility of slip casting finely divided natural graphite with the aid of protective colloids as deflocculating agents has been examined to some extent. Low densities resulted, and heat treatment at graphitizing temperatures failed to develop any strength in the cast specimens. Preliminary investigations of the effect of clay mineral impurities added as bentonite have indicated that this material causes a decrease in strength and increase in the permanent expansion of compacted natural graphite specimens heat treated to 1325°C. (auth)

LABORATORIES AND EQUIPMENT

Refer to abstract 896.

MOLECULAR STRUCTURE

955 CCC-1024-TR-206

Pennsylvania State Univ., University Park.

ELECTRIC DIPOLE MOMENTS OF THE METHYL FLUORO BORANES. R. K. Uenishi and C. G. Haas, Jr. Oct. 18, 1956. 40p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

The electric dipole moments of methyldifluoroborane and dimethylfluoroborane were determined in the gas phase, using the heterodyne beat frequency method. Dielectric constant measurements were made between 310.2° and 371.2°K, and in the pressure range from 50 to 560 mm. From the dielectric constants, the Debye constants were calculated. The electric moments were compared with theoretical electric moments calculated from Sanderson's electronegativities in order to evaluate the charge distribution within the molecule. Since the data show that the resultant moments of the two methyl fluoro boranes are different, the moments of the corresponding bonds must not be the same in the two cases. This difference in observed moments, together with the observed shortening of the B-F bonds, has been interpreted as being due to contributions of back-coordination in the B-F bonds. (auth)

956 AEC-tr-2658

INORGANIC COMPLEXES. A. E. van Arkel. Translated from Chem. Weekblad 52, 193-7(1956). 20p.

A theory of the formation and structure of inorganic complexes is presented. The correlations between the different groups of compounds which are formed by variation of the original complex are discussed in detail. (W.L.H.)

957

MOLYBDENUM(V) AND MOLYBDENUM(VI) COMPLEXES WITH ETHYLENEDIAMINETETRAACETIC ACID. Robert L. Pecsok and Donald T. Sawyer (Univ. of California, Los Angeles). J. Am. Chem. Soc. 78, 5496-5500(1956) Nov. 5.

An investigation of polarographic methods for the determination of Mo has led to a study of the complexes of Mo^{5+} and (VI) with ethylenediaminetetraacetic acid (EDTA) and its salts. Continuous variations studies of the spectrum of the complexed Mo^{5+} indicated two Mo per EDTA in the complex. Solid chelates were synthesized and analyzed for the elements. All data support the proposal that these chelates contain a molar ratio of metal to EDTA of 2.0. The formulas are $Na_2Mo_2O_{12}H_{12}C_{16}N_2 \cdot H_2O$ and $Na_4Mo_2O_{14}H_{12}C_{16}N_2 \cdot 8H_2O$ for the (V) and (VI) oxidation states, respectively. (auth)

958

MOLECULAR REARRANGEMENTS. X. REARRANGEMENT DURING THE DEAMINATION OF 1,2,2-TRIPHENYLETHYLAMINE WITH NITROUS ACID. William A. Bonner and Clair J. Collins (Stanford Univ., Calif. and Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 5587-93(1956) Nov. 5.

1,2,2-Triphenylethylamine, alternately labeled with radioactive carbon at carbon-1 and in the 1-phenyl nucleus, has been prepared and subjected to deamination with nitrous acid. 1,2,2-Triphenylethanol constituted over 95% of the product from these deaminations. The extent of isotope position isomerization attending the deaminations has been determined by oxidation of the carbinol products to benzophenone and benzoic acid, followed by radioactivity assay of these fragments. The net phenyl migration accompanying deamination of the carbon-1 labeled amine could be related to that observed during deamination of the 1-phenyl labeled amine using simple kinetic expressions based on the assumption of equilibrating classical 1,2,2-triphenylethylcarbonium ions as the sole reaction intermediates. The present radiochemical results thus lend strong support to the theory of equilibrating classical ions previously proposed to rationalize radiochemical data from tosylate solvolyses and dehydration reactions in the 1,2,2-triphenylethyl system. (auth)

RADIATION CHEMISTRY

959 UCRL-3071

California. Univ., Berkeley. Radiation Lab.

INDIRECT AND DIRECT ACTION OF HEAVY-PARTICLE RADIATION ON GLYCINE IN AQUEOUS SOLUTION (thesis). Boyd M. Weeks. July 11, 1955. 50p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

Glycine in aqueous solution, when irradiated with 30-Mev cyclotron-accelerated helium ions in the absence of dissolved oxygen, is shown to yield the following degradation products: hydrogen, carbon dioxide, carbon monoxide, ammonia, methylamine, glyoxylic acid, formaldehyde, acetic acid, and formic acid. About half a dozen compounds of greater complexity than the parent glycine are also formed, including: succinic acid and its amino-substituted derivatives, aspartic and diaminosuccinic acids. A method, based on ion-exchange chromatography, is described for the isolation, identification, and determination of the nitrogeneous products. Product-yield information for various glycine concentrations and radiation doses is presented which, together with published data for the x-ray irradiation of glycine, forms the basis of a proposed mechanism of action. (auth)

960

THE RADIATION CHEMISTRY OF ORGANIC SUBSTANCES. E. Collinson (Univ. of Leeds, England) and A. J. Swallow (Univ. of Cambridge, England). Chem. Revs. 56, 471-568 (1956) June.

A review of the radiation chemistry of organic substances is presented; it includes only reactions induced by x- and γ-rays, electrons produced in machines, β-particles from nuclear disintegration, protons, deuterons, α-particles, and neutrons, giving rise to extranuclear changes. (T.R.H.)

961

RADIATION INDUCED OXIDATION OF CHOLESTEROL. William G. Dauben and Pierre H. Payot (Univ. of California, Berkeley). J. Am. Chem. Soc. 78, 5657-60(1956) Nov. 5.

When C^{14}-labeled cholesterol is stored in the presence of air, it is oxidized on and about the 5,6-double bond and, in the main, the epimeric 7-hydroxy, the 7-keto and the 5α,6β-

dihydroxy derivatives are formed. Such an oxidation reaction requires both radiation and oxygen since unlabeled cholesterol in air or C^{14}-labeled cholesterol in vacuo are stable. (auth)

962

CONJUGATED REACTIONS DURING γ RADIATION ON AQUEOUS METHYLENE BLUE SOLUTIONS. A. I. Chernova, V. D. Orekhov, and M. A. Proskurnin (Karpov Moscow Inst. of Physical-Chemistry). Zhur. Fiz. Khim. 30, 1343-8(1956) June. (In Russian)

Investigations are made of radiochemical reaction (γ radiation from Co^{60}) of methylene blue decolorization. Reversible reduction of the dye in the presence of 1M glucose in a N_2 atmosphere yielded 5.2 ml/100 ev. Oxidation of the dye by Fe^{3+} produced the maximum yield of 7.8 eg/100 ev. The high yield can be explained by the participation in the process of excited water molecules. The additions of Mohr salts in concentration of 1×10^{-2}M prevented the dye from decolorization in strong solutions of sulfuric acid. (tr-auth)

RADIATION EFFECTS

963 ORNL-532

Oak Ridge National Lab., Tenn.

A SURVEY OF THE INFORMATION AVAILABLE CONCERNING THE EFFECTS OF RADIATIONS ON WATER. (With Particular Regards to the Application of Water as a High Temperature Pile Coolant). W. L. Sibbitt. Mar. 9, 1948. Decl. Sept. 6, 1956. 20p. Contract [W-7405-eng-26]. (CF-48-3-258). $4.80(ph OTS); $2.70(mf OTS).

The steady state conditions during irradiation of a material will approach the state normally described as the equilibrium state if the speed of the back reaction is sufficiently high as compared to the radiation intensity. Lower temperatures give the most favorable values of the equilibrium constant but higher temperatures give more favorable back reaction rates. The net result is that theoretically, for a given exposure, there should be an optimum operating temperature. The estimation of this optimum temperature is not amenable to theoretical treatment. However, the least upper bound may be estimated from the equilibrium constant. The % of dissociation of water becomes appreciable at temperatures above 2000°F. The addition of catalysts do not in any way influence the state normally described as the equilibrium state. Catalysts influence the steady state conditions by changing the reaction rates of some or all of the reactions. In this case, the net effect of adding palladium oxide is about the same effect as obtained by increasing the temperature. The approximate calculations indicate the order of values of the lower limits for dissociation of water in the temperature ranges of about 500°F. The steady state dissociation values must be above these thus they represent the limits approached as the reaction velocity is increased. (auth)

964 WADC-TN-55-686

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

CHROMATOGRAPHIC SEPARATION AND INFRARED EXAMINATION OF IRRADIATED N-1010 LUBRICANTS. Period covered: April 1955 to December 1955. John A. Parker and Freeman F. Bentley. Jan. 1956. 24p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: ORGANIC AND MICROANALYSIS. (AD-93571).

The chromatography data and the infrared spectra of non-irradiated and irradiated N-1010 lubricating oils are compiled. Three distinct fractions were separated from the oils by continuous chromatography and identified by infrared analysis as nujol, substituted aromatics, and aromatic esters. Although the effect was not very great, the significant changes indicated by the spectra of the N-1010 oil exposed to 10^8 Roentgens of a high energy gamma flux, appear to be the formation of compounds with aromatic character due to dehydrogenation and isomerization of the aliphatic and aromatic components, mild oxidation, and the formation of trans unsaturation. (auth)

965

POST-IRRADIATION OXIDATION IN RUBBER AND PLASTICS. W. C. Sears and W. W. Parkinson, Jr. (Oak Ridge National Lab., Tenn.). J. Polymer Sci. 21, No. 98, 325-6 (1956).

The oxidation of polystyrene and other high polymers during "cooling" after exposure to 10^{11} rad is studied. The changes in infrared spectra with time are cited in presenting possible mechanisms of oxidation. (T.R.H.)

966

COMPARISON OF SOME DIRECT AND INDIRECT EFFECTS OF IONIZING RADIATIONS IN PROTEIN. P. Alexander, M. Fox, K. A. Stacey, and D. Rosen (Chester Beatty Research Inst. and Institute of Cancer Research, London). Nature 178, 846-9(1956) Oct. 20.

967

EFFECT OF IONIZING RADIATIONS ON PECTIN. Z. I. Kertesz, Bruce H. Morgan, L. W. Tuttle, and Margaret Lavin (Cornell Univ., Geneva, N. Y.). Radiation Research 5, 372-81(1956) Oct.

RARE EARTHS AND RARE-EARTH COMPOUNDS

968 AD-86432

Pennsylvania State Univ., University Park.

FERROELECTRIC AND HIGH DIELECTRIC CRYSTALS: DIELECTRIC PROPERTIES AND PHASE TRANSITIONS OF $NaNbO_3$ AND $(Na,K)NbO_3$. Technical Report No. 23. G. Shirane, R. Newnham, and R. Pepinsky. Nov. 1, 1954. 31p. Contract AF33(616)-2133.

An optical, dielectric and structural study has been carried out on $NaNbO_3$ and the solid solution $(Na,K)NbO_3$, using both single crystals and ceramics. No evidence for ferroelectricity in $NaNbO_3$ was found, and the crystal seems to be antiferroelectric in accordance with the nonpolar structure reported by Vousden. It is shown that a small addition of$KNbO_3$ to pure $NaNbO_3$ produces a new ferroelectric phase, the existence of which suggests a possible explanation of the conflicting dielectric and structural properties previously reported. The phase diagram of $NaNbO_3-KNbO_3$ is given. This, together with the optical and x-ray studies of pure $NaNbO_3$, shows that the three phase transitions in $NaNbO_3$ are quite different in nature from the $BaTiO_3$-type transitions in $KNbO_3$. (auth)

969 ANL-5624

Argonne National Lab., Lemont, Ill.

ABSORPTION SPECTRA OF LANTHANIDE AND ACTINIDE RARE EARTHS. III. THE HEAVIER LANTHANIDE ELEMENTS IN AQUEOUS PERCHLORIC ACID SOLUTION. D. C. Stewart. Oct. 1956. 16p. Contract W-31-109-eng-38. $0.20(OTS).

The absorption spectra of the heavier lanthanides in aqueous $HClO_4$ in the range 220 to 1400 mμ are given. (T.R.H.)

970 KAPL-1607

Knolls Atomic Power Lab., Schenectady, N. Y.

SINTERING CHARACTERISTICS OF RARE EARTH OXIDES. G. L. Ploetz and C.W. Krystyniak. Oct. 22, 1956. 20p. Contract W-31-109-Eng-52. $0.20(OTS).

The sinterability of the pure oxides of Eu, Sa, Gd, and Dy was investigated at various temperatures in both oxidizing

and reducing conditions. Data are presented on density, grain size, and microhardness. Photomicrographs showing grain growth and microstructure are included. (auth)

971 TIL/T4630

A CONTINUOUSLY FUNCTIONING AUTOMATIC APPARATUS FOR THE SEPARATION AND QUANTITATIVE DETERMINATION OF RARE EARTH ELEMENTS IN A MIXTURE, BY MEANS OF ION EXCHANGE RESINS. (Su Una Apparecchiatura a Funzionamento Continuo ed Automatico per la Separazione e per la Determinazione Quantitativa Degli Elementi Delle Terre Rare in Miscela, Mediante Resine Scambiatrici de Ioni). L. Mazza. Translated from Atti accad. nazl. Lincei Classe sci. fis. mat. e nat. (8), 11, 80-5(1951). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-3545.

972

THE THERMOLYSIS OF THE RARE EARTH AND OTHER METAL NITRATES. Wesley W. Wendlandt (Texas Tech. Coll., Lubbock). Anal. Chim. Acta 15, 435-9(1956) Nov.

The thermolysis curves of the nitrates of La, Ce^{3+}, Pr, Nd, Sm, Y, Sc, Th, U^{4+} and Zr were determined. The oxide levels were obtained in the temperature range of 450 to 830°. (auth)

973

THE HEATS OF COMBUSTION OF DYSPROSIUM AND YTTERBIUM. Elmer J. Huber, Jr., Earl L. Head, and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 60, 1457-8(1956) Oct.

The heats of combustion of Dy and Yb in a bomb at 25 atm. O_2 are determined and heat of formation of the oxides calculated. (T.R.H.)

974

A STUDY OF THE KINETICS OF THE REACTION BETWEEN TIN(II) AND CERIUM(IV) IN AQUEOUS SULFURIC ACID SOLUTIONS. Carl H. Brubaker, Jr. and Anita Jeanne Court (Michigan State Univ. of Agriculture and Applied Science, East Lansing). J. Am. Chem. Soc. 78, 5530-3(1956) Nov. 5.

The kinetics of the reaction between tin(2^+) and cerium(4^+) in aqueous H_2SO_4 was studied in the temperature range from 0 to 25°. Three types of reaction were observed corresponding to low sulfate ion and $Sn(4^+)$ concentration, high sulfate ion and $Sn(4^+)$ concentrations, and the presence of colloidal $Sn(4^+)$ in the solutions. Only the first type seems subject to interpretation and appears to represent the stepwise oxidation of $Sn(2^+)$ by the tris-sulfatocerate(IV) ion. (auth)

SEPARATION PROCEDURES

975 AECD-4145

Oak Ridge National Lab., Tenn.

FURTHER STUDIES OF AMINES AS EXTRACTANTS FOR URANIUM FROM ACID SULFATE SOLUTIONS. J. G. Moore, K. B. Brown, and C. F. Coleman. June 24, 1955. Decl. with deletions Nov. 11, 1955. 96p. Contract W-7405-eng-26. $15.30(ph OTS); $5.40(mf OTS).

Since the first report on the use of amines as U extractants over eighty additional organo-nitrogen compounds have been examined for their ability to extract U from aqueous solutions, particularly sulfate solutions, of the types usually encountered in U ore processing. As before, the more promising of these (as well as other compounds previously reported) have been examined further with respect to other characteristics essential to practical application, i.e., reagent loss to the aqueous phase, compatibility with practicable diluents, influence of commonly present anions, reagent stability, sufficient selectivity for U, adequate phase separation properties, compatibility with practicable stripping methods, etc. The potential cost and availability of the reagents have also been considered. Several of the newer reagents tested, i.e., certain secondary and tertiary amines, have shown even greater promise as practicable extraction agents than many of the promising compounds previously tested. In addition to the work with sulfate liquors, cursory studies have been made of U extraction from fluoride and sulfate-fluoride solutions. Extractions of other metals from sulfate liquors, i.e., Ti and Th, have been briefly examined. (See also ORNL-1734.) (auth)

976 AECU-3146

Pennsylvania State Univ., University Park, Mineral Industries Experiment Station.

FLOTATION CHARACTERISTICS OF FLORIDA PHOSPHATE LEACHED ZONE MATERIAL. Progress Report No. 7. Robert E. Snow. Dec. 20, 1955. 27p. Project. G-32. Contract AT(49-6)-919. $6.30(ph OTS); $3.00 (mf OTS).

The results show that yields of concentrates ranged from 8 to 22% of the feed material and that grades as high as 22 to 28% P_2O_5, with recoveries of 44 to 62%, were obtained from feeds with as little as 5 to 10% P_2O_5. Concentrate grades as high as 0.011 to 0.018% U_3O_8, with recoveries up to 67%, were obtained from feeds with as little as 0.003 to 0.009% U_3O_8. The results also show a rejection, in all cases, of greater than 93% of the insoluble material available in the feed. The above results were obtained using oleic acid, fuel oil and pine oil as flotation reagents. The pH was in the range of 8.9 ± 0.2 and two cleaning stages were employed. By blending the concentrates obtained by flotation with those obtained by dry beneficiation grades of P_2O_5 were increased 1 to 2% and recoveries were increased 20 to 25%. The U_3O_8 recoveries were increased 10 to 20% but on the average the grades of U_3O_8 dropped one to three thousandths of the one %. (auth)

977 BMI-279

Battelle Memorial Inst., Columbus, Ohio.

NONAQUEOUS EXTRACTIVE METHODS FOR WESTERN URANIUM ORES. Final Report. R. A. Ewing, S. J. Kiehl, Jr., and A. E. Bearse. Jan. 31, 1955. Decl. Nov. 5, 1956. 50p. Contract AT(49-1)-635. $7.80(ph OTS); $3.30(mf OTS).

Outstanding settling rates and high extractions of U have been obtained with Western ores in hydrochloric acid–acetone systems; no sliming problems exist in such systens. Sulfuric acid can be partially substituted for HCl, up to equivalency with the limestone present, without seriously affecting U extraction or settling rates. The U may be recovered from the acetone leach liquor by neutralization with anhydrous NH_3 to produce a primary precipitate containing from 3 to 7% U. After removal of the bulk of the chlorides by washing or calcination, and removal of the V by a ferric vanadate precipitation, a U concentrate containing 60% U_3O_8 or over may be produced. Uranium and V have been volatilized from Western ores by high-temperature vapor-phase chlorination, using either Cl_2 at about 1000°C, or CCl_4 at 600°C. Removals of from 95 to 98% have been attained. Dissolution of carnotite in several readily liquefiable gases, including NH_3, SO_2, and SO_3, NO_2, and Cl, was found to be negligible, even in the presence of U complexing agents. No low-boiling liquids were found which would dissolve carnotite directly. (auth)

978 CF-55-9-85

Oak Ridge National Lab., Tenn.

RAW MATERIALS ECONOMIC STUDIES: A PRELIMINARY ESTIMATE OF THE COST OF URANIUM EXTRACTION

FROM A SLIME SLURRY. I. DEPA—CAPRYL ALCOHOL. B. B. Klima and R. R. Wiethaup. Sept. 21, 1955. Decl. May 2, 1956. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

At a cost estimate of recovering U from a H_2SO_4 slime slurry by extraction with di(2-ethylhexyl) phosphoric acid dissolved in a kerosene-capryl alcohol diluent is presented. (W.L.H.)

979 CF-56-4-79

Oak Ridge National Lab., Tenn.

RAW MATERIALS PROCESS TESTING. Progress Report of Engineering Section [for] January 1956. A. D. Ryon and K. O. Johnsson. Apr. 5, 1956. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Testing of the 6 in. turbine-agitated mixer in the Amex extraction equipment is continued. Studies into the prevention of formation of silica stabilized emulsions in amine extraction of high Si liquors are reported. Process efficiency with various ore slurries, and the use of various extractant diluents are studied. (T.R.H.)

980 CF-56-8-30

Oak Ridge National Lab., Tenn.

RAW MATERIALS PROCESS TESTING. Progress Report of Engineering Section [for] March 1956. A. D. Ryon and K. O. Johnsson. Aug. 6, 1956. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Batch tests of the effect of slime concentration on phase separation with both Amex and Dapex reagents are reported. Continuous, countercurrent tests of slime for minimizing Si stabilized emulsion formation in the Amex Process were made. Determination of the effects of C in the organic phase on the extraction coefficient and loading capacity of Amex and Dapex reagents was made. (For preceding period see CF-56-4-79.) (T.R.H.)

981 DOW-140

Dow Chemical Co. Western Div., Pittsburgh, Calif.

RECOVERY OF URANIUM FROM PLATEAU ORES BY SOLVENT EXTRACTION WITH Di-OPA. David A. Ellis, Doris C. Oberdin, Roberta, L. Mason, and Joseph B. Byrne. Apr. 4, 1956. 56p. Contract AT-30-1-Gen-236. $9.30(ph OTS); $3.60(mf OTS).

A study of the application of the di-OPA solvent extraction process to leach liquors of Plateau ores is reported. Countercurrent tests in the laboratory mixer-settler apparatus and bench-scale tests of various details of the process are described. A correlation of this data with that reported by other laboratories is attempted. (auth)

982 DOW-149

Dow Chemical Co. Western Div., Pittsburg, Calif.

PROGRESS REPORT [FOR] SEPTEMBER–OCTOBER 1956. Research Dept. R. H. Bailes. Nov. 1, 1956. 30p. Contract AT-30-1-GEN-236. $4.80(ph OTS); $2.70 (mf OTS).

Investigations of the chemistry of new methods of production of high grade U products directly from process liquors are reported. (For preceding period see DOW-147.) (auth)

983 DP-137

Du Pont de Nemours (E. I.) & Co. Savannah River, Lab., Augusta.

MIXER-SETTLER DEVELOPMENT. CHARACTERISTICS OF THE PUMP-MIX IMPELLER. D. S. Webster and C. L. Williamson. Oct. 1955. 24p. Contract AT(07-2)-1. $4.80(ph OTS); $2.70(mf OTS).

The characteristics of a mixer-settler impeller were found to be those of a high-capacity, low-head pump. These characteristics are not affected by recirculation from the mixing to the suction sections of the contactor. The discharge coefficient for recirculation of liquid through the annulus around the impeller nozzle is affected by the rotation of the impeller and decreases with increase in area of the annulus. (auth)

984 DP-141

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

AN EXPERIMENTAL SINGLE-TUBE EVAPORATOR. G. Starr Nichols and Edward S. Occhipinti. Jan. 1956. 27p. Contract AT(07-2)-1. $4.80(ph OTS); $2.70(mf OTS).

An experimental single-tube evaporator was evaluated for low-holdup evaporation of $UO_2(NO_3)_2$ solutions. Control of evaporation was adequate at high percentage evaporation, but entrainment was excessive. (auth)

985 HW-43319

Hanford Atomic Products Operation, Richland, Wash.

HAZARDOUS MATERIALS–REDOX PLANT. J. W. Underwood. May 22, 1956. 1956. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Each hazardous material used at the Redox plant is discussed as to toxicity, danger to skin, eyes, lungs, nasal passages, and flammability and explosion hazards. (T.R.H.)

986 JENER-44

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ANION EXCHANGE STUDIES OF PLUTONIUM. T. Sikkeland and J. Juul. Aug. 27, 1956. 10p.

The adsorption of Pu on Dowex-1 resin is studied. Regardless of concentration in HCl, Pu^{3+} is not adsorbed. Above 2.5 M HCl Pu^{4+} is adsorbed but is unstable in the 4 to 7 M range; Pu^{4+} is stabilized by $NaNO_2$. Above 3.6 M HCl, PuO_2^{2+} is adsorbed, however it reduces to Pu^{3+}, and attempts to stabilize it with Cl_2 or $K_2Cr_2O_7$ were unsuccessful. (T.R.H.)

987 K-1219

Oak Ridge Gaseous Diffusion Plant, Tenn.

AN EVALUATION OF SELECTIVE ELECTRODIALYSIS. H. H. Willard and J. J. Finley. Feb. 29, 1956. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The applications of selective electrodialysis have been demonstrated for the separation of unlike ions, the fractional separation of like ions, the dissolution of difficultly soluble salts, and the control of ionic strength or pH. The usefulness of the electrodialysis technique can be extended by changing ion charges with complexing agents or cathodic reduction and by a choice of solvents, both aqueous and organic. The behavior of Fe, Cr, Mo, W, and U ions has been characterized during selective electrodialysis in a number of common solvents. The behavior of metals in mixed solutions may be predicted from their behavior in simple systems. The limitations in the selectivity of the membranes commonly allowed migration of traces of analytically undesired ions. However, the relatively quantitative retention of U during electrodialysis from a bicarbonate catholyte using a cation selective membrane or from a perchloric catholyte using an anion selective membrane may be useful in analytical applications. The Hg cathode may be used with either of these catholytes to remove impurities. Demonstrations were made of gross separation of U from complex mixtures in bicarbonate and mixed acid solutions. (auth)

988 RMO-2035

International Minerals and Chemical Corp., Chicago.

URANIUM RECOVERY—ACIDULATION OF PHOSPHATE ROCK. Harold W. Long, Jr., J. B. Adams, and Roger Bart. Feb. 28, 1955. Decl. Oct. 27, 1955. 14p. Con-

tract AT(49-1)-545. (IMCC-2206). $3.30(ph OTS); $2.40(mf OTS).

In the acidulation of phosphate rock, HNO_3 is added to increase the U recovery. Data presented here show minimum cost for U_3O_8 to be obtained at an HNO_3 addition level of ~5 lb/ton of phosphate rock processed. (T.R.H.)

989 RMO-2618

Little (Arthur D.) Inc. [Western Labs.], San Francisco.
MERUCRY CATHODE CELL REDUCTION OF CARBONATE SOLUTIONS. Final Report. J. C. Huggins. Mar. 1955. 37p. Contract AT(49-6)-923. $6.30(ph OTS); $3.00(mf OTS).

A correlation of the rate of precipitation of V from carbonate leach solutions as a function of cathode current density and temperature is presented. This data should be adequate for design of a pilot-plant facility. Cost estimates show a high initial cost but a favorable operating cost. (See also RMO-2613.) (T.R.H.)

990 RMO-2619

Little (Arthur D.) Inc. Western Labs., San Francisco.
THE LEAD VANADATE PRECIPITATION METHOD FOR THE RECOVERY OF VANADIUM FROM CARBONATE LEACH SOLUTIONS. W. E. Clifford and J. C. Huggins. June 1955. 46p. Contract AT(49-6)-923. $7.80(ph OTS); $3.30(mf OTS).

A process for the removal (and recovery) of V from carbonate leach solution has been developed. Lead sulfate is used to precipitate V and is regenerated by treating the lead vanadate precipitate with H_2SO_4. Vanadium concentration can be reduced to any desired level, or removed completely, with essentially no carbonate or U losses. H_2SO_4 is the only reagent consumed making the process superior to $FeSO_4$ precipitation of V on an economic as well as efficiency basis. The removal of V from carbonate leach solutions improves the efficiency and economics of subsequent U recovery process. An economic evaluation compares the lead vanadate-caustic process with other possible processes for recovery of U and V from carbonate leach solutions. (auth)

991 RMO-2623

Little (Arthur D.) Inc. Western Labs., San Francisco.
SOLVENT EXTRACTION OF URANIUM FROM CARBONATE SOLUTIONS. W. E. Clifford, P. Noble, Jr., and E. P. Bullwinkel. June 1956. 19p. Contract AT(49-6)923. $4.80(ph OTS); $2.70(mf OTS).

Several systems were found by which U could be solvent extracted from carbonate leach solutions. All of these involved complexing the U as a singly charged negative ion and then extracting it with a singly charged organic cation (tetraalkyl ammonium ions are the most effective) into a suitable organic solvent. The most effective of the complexing agents was 8-hydroxyquinoline which reacts with uranyl to form the ion $UO_2(Ox)_3^-$. This system failed with slurries, where it would have had the greatest advantage by providing a means for avoiding filtration, since the tetraalkyl ammonium ions are strongly absorbed on the ore pulp. Very brief qualitative experiments suggested that it might be possible to float a sodium uranyl quinolinolate precipitate that is formed at high pH in the absence of an organic cation and solvent. Exploratory experiments also indicated that a system of absorbing 8-hydroxyquinoline on char and using this modified char to extract U from carbonate solutions or slurries might have possibilities. (auth)

992 TID-3307

Technical Information Service Extension, AEC.
URANIUM RECOVERY FROM RAW MATERIALS: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Sept. 1956. 39p. $0.30(OTS).

One hundred and sixty-two reports on uranium recovery from raw materials are annotated. References included were written prior to January 1953. A report number index is provided. (auth)

993 UCRL-4529

California. Univ., Livermore. Radiation Lab.
AN INTEGRATED MINIATURE SOLVENT EXTRACTION SYSTEM FOR PROCESSING RADIOACTIVE SOLUTIONS. Justin L. Bloom. June 21, 1955. 33p. Contract W-7405-Eng-48. $6.30(ph OTS); $3.00(mf OTS).

A small solvent extraction system with small hold-up and minimum shielding and employing a miniature mixer-settler for processing radioactive solutions is described. A semiportable unit employing several novel features of value in studies of solvent extraction flow sheets has been built and its operability as a research tool is demonstrated. (T.R.H.)

994 WIN-9

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
MISCELLANEOUS ELUTION STUDIES. A. R. Kazanjian. Mar. 5, 1956. 28p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

An investigation was made of the variables involved in a 5M $NaCl-H_2O$ elution scheme. The most promising procedure was used in a cyclic ion exchange system. Studies were also made on the effect of iron-to-phosphate ratios on U ion exchange and the effect of temperature on elution. (auth)

995 WIN-33

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
LABORATORY INVESTIGATIONS OF LEHIGH COAL AND NAVIGATION COMPANY ORE. George Trueman, E. S. Porter, and A. R. Kazanjian. Mar. 8, 1956. 19p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

The results of laboratory tests on a sample of ore from the Lehigh Coal and Navigation Company stockpile are described. The test work included acid leaching, filtration and thickening, and recovery of U from acid leach solutions by ion exchange. (auth)

996 WIN-37

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
SEMI-PILOT OPERATION OF THE AMMONIUM CARBONATE LEACHING PROCESS. E. T. Hollis. Feb. 27, 1956. 29p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

A process utilizing ammonium carbonate as a lixiviant for uranium and steam stripping as a means of recovery of the values has been tested. Some data are given on both leaching and precipitation aspects of the flowsheet. (auth)

997 AEC-tr-2550

ION-EXCHANGE RESINS USED IN ANALYTICAL CHEMISTRY. XV. APPLICATION OF HIGH-FREQUENCY ANALYSIS TO ION-EXCHANGE RESINS. Masatake Honda. Translated from Japan Analyst 2, 456-60(1953). 8p.

The application of high-frequency analysis in the determination of ion adsorption bands formed in ion-exchange resin layers is discussed. (W.L.H.)

998

SOME MODERN METALS AND CHEMICAL DEVELOPMENT. Ind. Eng. Chem. 48, 30A-3A(1956) Nov.

New uses for Sn, Ti, Nb, Ta, lanthanides, and their compounds are mentioned. Also, the use of chemicals in U extraction, as it affects the chemical industry, is discussed. (T.R.H.)

999

ELECTRICAL CONDUCTANCE STUDIES ON AN ION EXCHANGE RESIN. R. P. Puri, Frederick R. Duke, and June Lomnes (Iowa State Coll., Ames.). Iowa State Coll. J. Sci. 31, 25-31(1956) Aug. 15.

The relative conductivity of univalent ions in an exchange resin compared to that in aqueous solution indicates that the ions have similar hydration and mobility in the two media. This is further bolstered by the effect of changing solvent on the conductivity. The energy of activation for conductance indicates that the bivalent ions are as loosely held to the resins as the univalent ions, but that steric factors greatly reduce the conductivity of the bivalent ions. (auth)

1000

INTERRELATIONSHIPS IN THE SOLVENT EXTRACTION BEHAVIOUR OF SCANDIUM, THORIUM, AND ZIRCONIUM IN CERTAIN TRIBUTYL PHOSPHATE-MINERAL ACID SYSTEMS. D. F. Peppard, G. W. Mason, and J. L. Maier (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 3, 215-28(1956) Oct.

The extraction behavior of Sc and that of Th in the aqueous HCl-TBP (tributyl phosphate) system differ sufficiently that these elements are readily separable. Although the respective extraction curves tend to converge as the HCl concentration is lowered, they do not intersect. In contrast, the Sc and Th extraction curves in the HNO_3-TBP systems mutually cross. The complete Zr extraction curves have not been determined, but the Zr extraction curve in the HNO_3-TBP system is shown to cross both the Sc and Th curves. Consequently, in this system, any one of the three elements may be separated as product from the other two as contaminants. In the HCl-TBP system, the TBP dependency of the extraction coefficients for Sc and Th are not readily interpretable. In the HNO_3-TBP system the TBP dependencies are operationally fourth-power at high HNO_3 concentrations and considerably less than fourth-power at intermediate and low HNO_3 concentrations. The mutual separation of a Th-Sc mixture and of a Th-Zr mixture in the HCl-TBP system and the isolation of each of the three elements as product from a Sc-Th-Zr mixture in the HNO_3-TBP system are demonstrated. (auth)

1001

A MANGANESE-DIOXIDE PROCEDURE FOR ISOLATION AND CONCENTRATION OF PROTACTINIUM FROM IRRADIATED THORIUM COMPOUNDS. Leonard I. Katzin (Argonne National Lab., Lemont, Ill.) and Raymond W. Stoughton (Oak Ridge National Lab., Tenn.). J. Inorg. and Nuclear Chem. 3, 229-32(1956) Oct.

Traces of Pa may be coprecipitated on MnO_2 with good recovery from solutions 1N to 4N in HNO_3 upon precipitating 1.5 g of dioxide/l. by the addition of $KMnO_4$ to manganous nitrate in excess. Good separation is obtained from macro concentrations of $Th(NO_3)_4$. In concentrations up to 0.65M the Th does not interfere with the precipitation, while at twice this concentration definite interference is found owing to the effect on the physical properties of the solution. With the aid of NH_2OH to redissolve the dioxide, it is possible to concentrate the Pa with respect to carrier by a factor of 100 per cycle. Less satisfactory were H_2O_2, $NaNO_2$ and HCOOH. Simultaneous purification from Th and U may be achieved. Thorium is found to carry well in trace concentrations, but the effciency of this process falls off with increasing Th concentration. (auth)

1002

RAPID ION-EXCHANGE TECHNIQUES FOR RADIOCHEMICAL SEPARATIONS. E. C. Campbell and F. Nelson (Oak Ridge National Lab., Tenn.). J. Inorg. and Nuclear Chem. 3, 233-42(1956) Oct.

The short-lived nuclear isomers, Pb^{207m} (0.8 sec) and Ir^{191m} (4.9 sec) have been identified and characterized after rapid anion-exchange separation from their long-lived parents, Bi^{207} (8 years) and Os^{191} (16 days). Diffusion of daughter activities from the resin to solution phase is sufficiently rapid to permit satisfactory separation from the parent activities. In the strong base anion exchanger used, the diffusion coefficient of tracer Pb^{2+} was found to be 7.8×10^{-6} cm^2/sec at 25°C. The yield of the Pb^{207m} separation as calculated from diffusion theory and the measured diffusion coefficient of Pb^{2+} is in fair agreement with that observed. Results are discussed in regard to general applicability of the ion-exchange technique for rapid separations. (auth)

1003

ION-EXCHANGE SEPARATIONS OF THE LANTHANIDES AND ACTINIDES BY ELUTION WITH AMMONIUM ALPHA-HYDROXY-ISOBUTYRATE. H. Louise Smith and Darleane C. Hoffman (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 3, 243-7(1956) Oct.

Lanthanide and actinide separations by means of elution with ammonium α-hydroxy-isobutyrate solutions at room temperature from Dowex 50-X4 resin columns were investigated. Separations comparable to those reported for elution from Dowex 50-X12 resin columns with hot ammonium α-hydroxy-isobutyrate were obtained. The simplicity and convenience of the method recommend it for use on the tracer scale. (auth)

1004

SEPARATION OF ACTINIDE ELEMENTS BY CATION EXCHANGE USING ALPHA-HYDROXY ISOBUTYRIC ACID. J. Milsted and A. B. Beadle (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 3, 248(1956) Oct.

The separation factors for Am, Cf, and Cm by elution from Zeo-Karb 225 resin with α-hydroxy isobutyric acid are determined. (T.R.H.)

1005

METHOD OF SEPARATING PLUTONIUM. F. Morgan (Canada). British Patent 754,651. Nuclear Eng. 1, 316 (1956) Oct.

To separate Pu from U and fission products, the mixture is dissolved in HNO_3. Insoluble phosphates of Pu, Zr, Bi and Zr nitrates are precipitated. Niobium, Bi, and Nb were precipitated by adding soluble phosphate and the precipitated phosphates treated oxalic acid. The compounds of Zr and Nb are soluble while an insoluble precipitate of Bi and Pu is separated by HCl treatment. (F.S.)

1006

PROCESSING OF POWER REACTOR FUELS. R. E. Blanco (Oak Ridge National Lab., Oak Ridge, Tenn.). Nuclear Sci. and Eng. 1, 409-19(1956) Oct.

Heterogeneous reactor reprocessing problems are discussed primarily from the viewpoint of a central solvent extraction reprocessing station. The currently proposed fuels have been classified into types to minimize the number of processing schemes required. Primary emphasis is placed on a description of alternate methods for converting fuels to a nitric acid soluble form and the effects of radiation and inert alloy metals on the solvent extraction method. Head-end methods include acid dissolution, oxidation, hydrochlorination, chlorination, carburization, molten metal dissolution, and electrolytic dissolution. A new reprocessing method, the Hermex process, which uses mercury as the dissolving agent, is also presented. Schematic flowsheets for proposed methods are included. (auth)

1007

SLOW PRECIPITATION PROCESSES. SOME APPLICATIONS TO ANALYTICAL AND PHYSICAL CHEMISTRY.

Louis Gordon (Syracuse Univ., N. Y.). Record Chem. Progr. Kresge-Hooker Sci. Lib. 17, No. 3, 125-43(1956).

Refer also to abstract 1323.

SORPTION PHENOMENA

1008 AEC-tr-2677

VARIATIONS OF THE ATTERBERG CONSTANTS IN CLAYEY MATERIALS OF LAMINAR STRUCTURE AS A FUNCTION OF THE SATURATING CATION. Angel Hoyos de Castro and Mercedes García Muñoz. Translated by K. S. Bevis from Anales edafol. y fisol. vegetal (Madrid) 13, 1-8(1954). 6p.

The Atterberg constants (plastic limit, liquid limit, plasticity index) for bentonites are determined as a function of saturating cation. (T.R.H.)

1009

EFFECTS OF THE NATURE OF THE SURFACE ON THE SORPTION PROPERTIES OF SILICA GELS. I. E. Neĭmark, R. Yu. Sheĭnfaĭn, and L. G. Svintsova (Pisarzhevskiĭ Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 108, 871-4(1956) June 11. (In Russian)

Investigations were made of the hydrophilic nature of silica gel surfaces, their sorptive properties, and the effects produced by the chemical nature and porosity of silica gel surfaces in adsorption processes. To solve the problem the silica gel hydroxides were replaced by fluorite, the anions of which differ sharply from OH groups in their capacity to form hydrogen complexes. The sorption properties of silica gels with changed surfaces were compared to silica gels of identical structure but with hydroxide coated surfaces. Diagrams are given to show the sorption and desorption isotherms of methyl alcohol and benzoyl vapors on hydrophilic and fluorite silica gels of fine and large porosity. (R.V.J.)

1010

A STUDY OF MIXED GAS ADSORPTION ON MERCURY. Robert S. Hansen and Doris V. Stage (Iowa State Coll., Ames). Iowa State Coll. J. Sci. 31, 33-47(1956) Aug. 15.

The adsorption of gaseous ethanol–heptane mixtures by mercury was investigated theoretically and experimentally. The virial treatment of mobile monolayers of one component was generalized to two components and found to apply satisfactorily over the pressure range in which adsorption of monolayer character could be expected. In the course of the experimental investigation, apparatus suitable for controlled atmosphere investigation of boundary tensions, including boundary tension measurements in high vacuum, was designed, constructed, and shown to be practical in use. (auth)

SYNTHESES

1011 AEC-tr-2673

METAL CARBONYLS. XX. THE METAL HEXACARBONYLS OF THE CHROMIUM GROUP: THEIR METHOD OF FORMATION AND THE REACTION MECHANISM OF THESE METHODS. W. Hieber and E. Romberg. Translated by R. S. Forsyth from Z. anorg. u. allgem. Chem. 221, 321-31(1935). 9p.

The method of preparation of Cr, Mo, and W hexacarbonyls is given and their chemical behavior described. The mechanism of their formation, by means of the reaction of CO on metal chlorides in the presence of Grignard reagent, is discussed. (T.R.H.)

1012

THE PREPARATION OF 3,4-BIS(2-FURYL)-1,2,5-OXADIAZOLE. Charles V. Banks and Clara I. Adams (Iowa State Coll., Ames). J. Org. Chem. 21, 815(1956).

The preparation of 3,4-bis (2-furyl)-1,2,5-oxadiazole by treatment of α-furildioxime with urea solution, and also by reaction of α- and γ-furildioxime with H_2O in a closed tube is described. (T.R.H.)

TRACER APPLICATIONS

1013 AECU-3363

Michigan. Univ., Ann Arbor.

O^{18} STUDY OF THE REACTION OF HYDROXIDE WITH MERCURY(II) NITRATE. CHARACTERIZATION OF BASIC MERCURY(II) NITRATES. Technical Report [on] FUNDAMENTAL RESEARCH ON ISOTOPIC REACTIONS. Richard B. Bernstein, Harry G. Pars, and Doris C. Blumenthal. Oct. 1956. 21p. Contract AT(11-1)-321. $4.80(ph OTS); $2.70(mf OTS).

O^{18} tracer experiments have been carried out to investigate the source of the oxygen in HgO precipitated by the reaction of hydroxide ion with mercury (II) nitrate. In addition, an O^{16}/O^{18} isotope effect in the reaction was observed; O^{16} concentrates in the precipitated oxide. Three crystalline basic nitrates of Hg(II) were prepared and characterized by x-ray diffraction and infrared techniques. To elucidate the ionic species in mercury (II) nitrate solutions, Raman spectra were obtained. A band at 354 cm^{-1} was observed which disappeared upon adding nitric acid, suggesting the possibility of Hg–O linkages. The results of the present investigation indicate a mechanism whereby the reaction of mercury (II) nitrate with hydroxide ion proceeds via the formation of the basic nitrate $Hg_3O_2(NO_3)_2 \cdot H_2O$, which upon hydrolysis yields HgO. The oxygen in the HgO is derived from the water which effects the hydrolysis. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

1014

CRYSTAL STRUCTURE OF DELTA-PRIME PLUTONIUM AND THE THERMAL EXPANSION CHARACTERISTICS OF DELTA, DELTA-PRIME, AND EPSILON PLUTONIUM. F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.). J. of Metals 8, (Sect. II), 1256-9(1956) Oct.

The δ' plutonium is found to be body-centered-tetragonal with two atoms per unit cell at 000 and ½, ½, ½. The unit cell dimensions at 477°C are a = 3.339 ± 0.003A and c = 4.446 ± 0.007A, which lead to a calculated density of 16.01 g per cu cm. Each Pu atom is surrounded by 12 others at a mean distance of 3.275A. The linear coefficient of thermal expansion perpendicular to the c-axis is $10^6\,\bar{\alpha}_a = 305 \pm 35$ per °C, and parallel to the c-axis is $10^6\,\bar{\alpha}_c = -659 \pm 67$ per °C. The average linear coefficient, $(2\bar{\alpha}_a + \bar{\alpha}_c)/3$, is equal to $10^6\,\bar{\alpha}_L = -18 \pm 28$ per °C. The linear coefficient of theamal expansion of face-centered-cubic δ plutonium is found to be $10^6\,\bar{\alpha}_L = -8.6 \pm 0.3$ per °C, and of body-centered-cubic ε plutonium $10^6\,\bar{\alpha}_L = 36.5 \pm 1.1$ per °C. (auth)

1015

THE REACTION BETWEEN Pu(III) AND OXYGEN IN AQUEOUS SULFATE SOLUTIONS. T. W. Newton and F. B. Baker (Los Alamos Scientific Lab., N. Mex.). J. of Phys. Chem. 60, 1417-21(1956) Oct.

The rate of oxidation of Pu^{3+} by O_2 in aqueous sulfate solutions has been investigated at 25° at an ionic strength of 2. The initial reaction is $2Pu^{3+} + 2H^+ + O_2 = 2Pu^{4+} + H_2O_2$. Its rate was found to be first power in O_2, second power in Pu^{3+}, zero power in Pu^{4+}, and essentially zero power in H^+ concentration. The rate depends on the SO_4^{2-} concentration in

a complicated way which may be explained on the basis of reaction by two parallel paths, one involving two and the other involving three sulfate groups in the activated complexes. In one run at 35° the rate was found to be about 2.9 times as fast as at 25° in solutions with the same concentrations of reactants. This leads to an over-all average activation energy of about 19 kcal. (auth)

TRITIUM AND TRITIUM COMPOUNDS

1016 KAPL-1097

Knolls Atomic Power Lab., Schenectady, N. Y.
THE PALLADIUM–TRITIUM SYSTEM AT LOW TEMPERATURE. R. M. Haag and F. J. Shipko. June 1, 1956. 40p. Contract W-31-109-Eng-52. $0.30(OTS).

The system Pd–H^3 has been studied at 0, -80, and -100 -100°C. At 0°C, equilibrium was readily obtained. At lower temperatures, the production of He^3 by the radioactive decomposition of H^3 imposed limits upon the duration of any run, and, in conjunction with the slower reaction rates, decreased the precision obtainable. (auth)

Refer also to abstract 980.

URANIUM AND URANIUM COMPOUNDS

1017 BMI-840

Battelle Memorial Inst., Columbus, Ohio.
THE SOLUBILITY OF OXYGEN IN URANYL SULPHATE SOLUTIONS AT ELEVATED TEMPERATURES. H. A. Pray and E. F. Stephan. June 10, 1953. Decl. June 1, 1955. 20p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

The solubility of O_2 in UO_2SO_4 solutions and in H_2O at 212, 275, and 325°F, and at O_2 partial pressures up to 1500 psia was investigated. The results are presented in tabular and graphic form. The solubility is proportional to the partial pressure of O_2. The ratio of solubility in the UO_2SO_4 solution to solubility in water at the same temperature and pressure is a function of the concentration of the salt in solution. (auth)

1018 DOW-66

Dow Chemical Co. Western Div., Pittsburg, Calif.
THE RECOVERY OF URANIUM FROM MISCELLANEOUS MATERIALS. Progress Report [for] June–December, 1951. R. H. Bailes. Jan. 2, 1952. Decl. Oct. 23, 1956. 45p. Contract AT-30-1-GEN-236. $7.80(ph OTS); $3.30 (mf OTS).

The recovery of U and V from Lukachukai ore by means of organic phosphates is being investigated. Details of leaching with either aqueous acid or organic phosphate plus diluent are reported. Further investigation of the recovery of U from Rifle acid leach liquors by ion exchange is described. New resins and the adsorption and elution processes were studied. The separation of As and U during recovery of U from Eldorado liquor by ion exchange is reported, as is further work on the recovery of U from Mallinckrodt raffinate by ion exchange. (auth)

1019 LA-1996

Los Alamos Scientific Lab., N. Mex.
SPECTROPHOTOMETRIC AND SOLVENT EXTRACTION STUDIES OF URANYL PHOSPHATE COMPLEXES. Burton J. Thamer. Feb. 23, 1956. 85p. Contract W-7405-eng-36. $0.50(OTS).

A study of uranyl phosphate complexes has been made at an ionic strength of 1.06 to 1.07 and a temperature of 24 to 25°C. The spectrophotometric study yielded to formation constant of 15.5 for the complex $UO_2H_2PO_4^+$. The solvent extraction data showed that the further complexes $UO_2(H_2PO_4)_2$ and $UO_2(H_2PO_4)_2 \cdot H_3PO_4$ have the formation constants 21.8 and 10.2, respectively. No statistically significant evidence has been obtained for the existence of a still higher complex. (auth)

1020 RMO-2620

Little (Arthur D.) Inc. Western Labs., San Francisco.
STUDIES ON THE CHEMICAL BEHAVIOR OF URANIUM MINERALS AND COMPOUNDS. W. I. Watson, C. J. Hoffman, and E. P. Bullwinkel. July 1955. 24p. Contract AT(49-6)-923. $4.80(ph OTS); $2.70(mf OTS).

The solubilities of thirteen different minerals in carbonate and acid leach solutions and the effects of roasting and oxidation treatments on solubilities of specific mineral samples have been determined. Some interactions of ore constituents during roasting and the effect on subsequent uranium extractions are indicated. (auth)

1021 RMO-2621

Little (Arthur D.) Inc. Western Labs., San Francisco.
CATALYSIS OF AIR AND HYPOCHLORITE OXIDATION OF URANIUM COMPOUNDS IN CARBONATE LEACH SLURRIES. W. E. Clifford, E. E. Larkin, and E. M. Smith. June 1956. 33p. Contract AT(49-6)-923. $6.30(ph OTS); $3.00(mf OTS).

More efficient methods (in terms of reagent cost and leaching time) for the oxidation of reduced U compounds in carbonate slurries were sought. It was found that copper salts, at 25 mg/l Cu (especially in the presence of ammonia), increased the rate of air oxidation by factors ranging up to about 10 for U_3O_8 and about 3 for UO_2. Wards uraninite also dissolved at a more rapid rate by a factor of up to 2.5. Use on various ores at a concentration of 1 g/l of contained U_3O_8 shows 25 mg/l Cu plus aeration to be substantially superior to aeration alone in the cases of two ores and of no advantage in the cases of two others. 25 mg/l Cu^{+2} in the presence of ammonia plus aeration was superior to Cu plus aeration in all cases and appeared equal to or better than 600 mg/l $KMnO_4$ plus aeration. Copper salts also appear to catalyze hypochlorite oxidation of reduced U compounds. 833 mg/l Cl_2 as hypochlorite plus aeration, uncatalyzed, appears to be as effective as the 600 mg/l $KMnO_4$ on the ores tested. The amount of work done on hypochlorite oxidation, catalyzed or not, is insufficient to make recommendations other than that further work should be done. (auth)

1022 WIN-45

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
FINAL REPORT OF THE ALKALINE LEACH—FILTRATION PILOT PLANT TESTING OF LA SAL ORE. A. W. Griffith, T. F. Izzo, D. O. Skiles, and G. Winslow. Apr. 5, 1956. 64p. Contract AT(49-6)-924. $10.80(ph OTS); $3.90(mf OTS).

La Sal ore from the Big Indian Wash district of Utah was treated for a second time in the Alkaline Leach–Filtration Pilot Plant at Grand Junction because of a suspected change in ore characteristics as mining progressed. Information is included on grinding, thickening, leaching, residue filtration, and precipitation. A section on mill design considerations is also included. Results show the ore to be amenable to the Alkaline Leach–Filtration Process. (auth)

1023 Y-1144

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
URANIUM CONCENTRATION METER. Orville Arnett. Sept. 24, 1956. 29p. Contract W-7405-eng-26. $0.25 (OTS).

Two basic instruments were developed for determining the concentration of U in solutions. Both instruments detect the γ activity present in a sample solution, and interpret this analysis into direct presentation as parts per million. One basic instrument design analyzes samples containing U in the presence of other elements that emit γ rays. The second design analyzes samples containing only U as the γ ray source. (auth)

1024 AEC-tr-2660

THE SEPARATION OF URANIUM ISOTOPES WITH THE SEPARATION NOZZLE. E. W. Becker and R. Schütte. Translated from Z. Naturforsch. 11a, 679(1956). 3p.

A technique for the separation of U isotopes is described which depends upon the partial spatial separation of gases of different mass in a nozzle flow. Results are reported from experiments with UF_6. (C.H.)

1025

THE RATES OF REACTION OF COPPER, ZINC, AND URANIUM WITH ORGANIC SOLVENT-DINITROGEN TETROXIDE MIXTURES. C. C. Addison, J. C. Sheldon, and N. Hodge (The Univ., Nottingham). J. Chem. Soc., 3900-11(1956) Oct.

The rate of reaction between metals and liquid N_2O_4 is increased considerably when the tetroxide is mixed with certain organic solvents; this is illustrated by measurements with Cu, Zn, and U. Solvents which act as electron-donors (Don) to the tetroxide set up the equilibrium $[(Don)_n, NO^+]NO_3^- \rightleftharpoons n(Don) + N_2O_4 \rightleftharpoons (Don)_n.N_2O_4$, in the liquid state, and the enhanced reaction reflects the increase in concentration of ionic species. Rates of reaction with oxygen-donor solvents diethyl ether, ethyl acetate, dioxan, and acetic anhydride, the nitrogen-donor solvents phenyl cyanide, benzyl cyanide, methyl cyanide, and diethylnitrosamine, and the non-donor solvent nitromethane are reported over the full liquid concentration range. The variation of reaction rate with concentration has been classified into three types, and each type is interpreted in terms of the dielectric constant of the liquid, the concentration of simple NO^+ ions or complex $(Don)_n.NO^+$ ions, the relative powders of the solvent and the NO_3^- ion to act as desorbing agent for the metal cation formed on initial reaction at the metal surface, and the minimum stable valency of the metal. The activation energy of the reactions has been determined. Stirring influences the speed of the reaction, but not its type or activation energy. (auth)

Refer also to abstracts 929 and 981.

WASTE DISPOSAL

1026 TID-7517(Pt. 1)

Division of Reactor Development, AEC and Public Health Service, Washington, D. C.

SANITARY ENGINEERING ASPECTS OF THE ATOMIC ENERGY INDUSTRY. A SEMINAR SPONSORED BY THE AEC AND THE PUBLIC HEALTH SERVICE, HELD AT THE ROBERT A. TAFT ENGINEERING CENTER, CINCINNATI, OHIO, DECEMBER 6-9, 1955. 635p. (Issued in two parts: (Pt. Ia), 322p. and (Pt. Ib), 313p.). $3.10 (OTS).

ENGINEERING

1027 ISC-585

Ames Lab., Ames, Iowa.

A PROPORTIONING FURNACE TEMPERATURE CONTROLLER. Harry J. Svec, Alvin A. Read, and Dale W. Hilker. Mar. 10, 1955. 10p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

An electronic device has been developed which detects changes in furnace temperatures by means of a sensitive resistance which may be an integral part of the furnace. Performance tests in the temperature range 100 to 700°C have been made and control has been maintained to less than ±0.1°C for periods as long as 48 hours. (W.L.H.)

1028 WIAP-2

Westinghouse Electric Corp. Industrial Atomic Power [Group], Pittsburgh.

COMPARATIVE PERFORMANCE OF MODERN STEAM TURBINE GENERATOR UNITS FOR ATOMIC POWER PLANTS. N. A. Beldecos, A. R. Jones, and A. K. Smith. Mar. 1953. 37p. $6.30(ph OTS); $3.00(mf OTS).

Performance data are presented for utilization in an integrated study of the economic aspects of atomic power. A performance level and trend is established which is representative of that which can be anticipated for modern turbines. The study is based on turbogenerator units of 100 to 200 Mw capability operating at 1.5 in. Hg. abs. back pressure. The turbine cycle efficiency is presented for non-reheat regenerative cycles with throttle steam conditions ranging from 150 psig saturated steam to 2400 psig and 1100°F. Means are provided for estimating the performance of these cycles with variations in the number of heaters and final feedwater temperature. Consideration is given to the application of reheat for the improvement of performance and the reduction of moisture. The application of single reheat improves cycle efficiency by about 4.5% and reduces the moisture about 50%. In addition to the information on cycle efficiencies, data pertaining to throttle flow, condenser flow, heat added in boiler, moisture in exhaust, and exhaust annulus area are presented. The comparative performance of all regenerative cycles considered is presented as a function of end point moisture for the entire range of steam conditions. (auth)

AEROSOLS

1029

AEROSOL SIZE FOR MAXIMUM PENETRATION THROUGH FIBERGLAS AND SAND FILTERS. J. W. Thomas and R. E. Yoder (Oak Ridge National Lab., Tenn.). Arch. Ind. Health 13, 545-9(1956) June.

1030

AEROSOL PENETRATION THROUGH A LEAD-SHOT COLUMN. A METHOD OF PARTICLE-SIZE ESTIMATION. J. W. Thomas and R. E. Yoder (Oak Ridge National Lab., Tenn.). Arch. Ind. Health 13, 550-5(1956) June.

HEAT TRANSFER AND FLUID FLOW

1031 AERE-Inf/Bib-104

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

METHODS OF MEASURING THE THERMAL CONDUCTIVITY OF SOLIDS: A BIBLIOGRAPHY. G. L. Cooper. July 1956. 12p.

1032 AGC-AF-25

Aerojet General Corp., Azusa, Calif.

EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID-FLOW SYSTEMS. Part 2 of Quarterly Progress Report No. 1 Covering Period June 22 through September 30, 1956. (1310-1). Leon Green, Jr. Oct. 31, 1956. 38p. Project 6-(1-9964). Contract AF33(616)-3767.

High-temperature strength properties of graphite are being investigated. Studies on heat transfer in porous graphite and nozzle flow behavior are reported. (J.H.M.)

1033 BMI-1065

Battelle Memorial Inst., Columbus, Ohio.

BURNOUT HEAT FLUX IN A RECTANGULAR CHANNEL. David A. Dingee, Harold M. Epstein, Joel W. Chastain, and Sherwood L. Fawcett. Jan. 10, 1956. 14p. Contracts NO-200-023 and W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

An experimental study was made of burnout heat flux to water in a rectangular channel 0.087 by 1 in. in cross section and $12\frac{1}{16}$ in. long. Tests were performed at an ambient pressure of 2000 psia and include a range of flow rates from about 0.2 to 0.5×10^6 lb per (hr)(ft^2). Quality burnout data were obtained for two inlet subcoolings, 10 and 60°F; in addition, tests with conditions at the outlet from the test section near saturation temperature with no net vapor generated were performed. These tests were in the nature of an experimental check of previous data obtained by WAPD using the same rectangular channels but with an entirely different test technique. It was found that the quality burnout data for 10°F inlet subcooling agree very well with WAPD results. The 60°F inlet subcooling data fall about 10% above the corresponding WAPD data. Battelle tests at zero exit quality and near zero exit subcooling generally terminated in an instability of flow and pressure. The heat fluxes producing this instability agree favorably with WAPD burnout data under similar conditions. It is concluded that differences in the experimental setup do not lead to significantly different results. (auth)

1034 CAL-HF-710-D-10

Cornell Aeronautical Lab., Inc., Buffalo.

SURVEY REPORT OF THE STATE OF THE ART OF HEAT TRANSFER IN MINIATURIZED ELECTRONIC EQUIPMENT. James P. Welsh and Richard Y. Booth. Mar. 3, 1952. 89p. Contract No. NObsr-49228. (ATI-158256).

A survey report on the state of the art of heat transfer in miniaturized electronic equipment is presented. The power densities and ambient temperatures encountered in current miniaturized electronic equipment exceed those of conventional equipment, and special methods of heat removal are in use. The heat transfer techniques presently applied are in an early stage of development and the thermal findings of several organizations differ from those of others. The primary heat transfer problem in electronics is the removal of internally developed heat through a reduction of the thermal impedance between heat sources and the ultimate sink. A discussion on forced air cooling, liquid cooling, and evaporation cooling of miniaturized electronic equipment is included. It was determined that in general, miniaturized electronic equipment can be successfully cooled utilizing the currently known techniques. (auth)

1035 CF-52-11-189

Oak Ridge National Lab., Tenn.

FORCED CONVECTION HEAT TRANSFER TO SLURRIES IN TUBES. R. V. Bailey. Nov. 24, 1952. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An equation is derived which predicts the coefficient of heat transfer from tube wall to slurry for laminar flow. (T.R.H.)

1036 CF-56-10-35

Oak Ridge National Lab., Tenn.

SOLIDS DISPERSED IN LIQUIDS. D. G. Thomas. Oct. 1, 1956. 36p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Information is presented on the theoretical aspects and fundamental relations of newtonian and non-newtonian (bingham-plastic, pseudo-plastic, dilatant, thixotropic and rheopectic materials) suspension. Generalized shear-stress-shear-rate relations are given. Flow of suspensions through circular conduits are discussed. Experimental results are presented on the flow of UO_2 and ThO_2 slurries. (W.L.H.)

1037 NP-6148

United Aircraft Corp., East Hartford, Conn.

A GENERALIZED APPROACH TO THE DEFINITION OF AVERAGE FLOW QUANTITIES IN NONUNIFORM STREAMS. George McLafferty. Dec. 1955. 83p. (SR-13534-9).

This report was originally published in July 1954 as a UAC Research Department internal report.

Definitions and applications are studied of average quantities in incompressible and compressible flow. Forms of average total pressure and velocity which can be used to describe the integrated properties of a ducted nonuniform flow are derived for both the compressible and incompressible cases. Derivations and methods of determining momentum and kinetic factors that describe the shape of a velocity profile are included. (J.H.M.)

1038 PDGW-EMR/52/2

Imperial Coll. of Science and Tech., London. Jet Research Lab.

FLOW THROUGH POROUS MATERIALS. THE RETARDATION OF LIQUID FLOW RATES IN POROUS MATERIALS. PART I. EVIDENCE AND CONFIRMATION. P. Eisenklam and C. M. Hargreaves. June 1952. 46p. (JRL-23; ATI-183485).

The flow of distilled water through porous stainless steel, porous bronze, and sintered Hysil glass is investigated. Experiments show that the resulting corrosion affects retardation in flow rates, porosity of the material, and permeability. A discussion of the corrosion of porous stainless steel and porous bronze by distilled water, and a determination of isobars of the laminar flow of a fluid through a porous disc are included. (J.H.M.)

1039 WADC-TR-54-100(Pt. 2)

North Carolina State Coll., Raleigh.

BOUNDARY LAYER RADIOACTIVE TRACER TECHNIQUE. PART II. APPLICATION. Final Report. Kenneth O. Beatty, Jr., James K. Ferrell, and Frances M. Richardson. Sept. 1956. 55p. Project title: WIND TUNNEL STUDIES. Task title: BOUNDARY LAYER RADIOACTIVE TRACER TECHNIQUE. Contract AF33(616)-31. (AD-97302).

The tracer displacement technique was applied to fluid-dynamic studies with aqueous solutions in tubes of one-half and one-inch diameter under conditions of turbulent flow in smooth tubes, laminar flow in artificially roughened tubes, laminar flow with superposed fluid vibration, non-Newtonian flow at low velocities, and flow accentuating mass transfer effects. Turbulent flow observations have been made on fluids starting initially from rest and also under dynamic conditions where flow velocity and pattern were fully established prior to any tracer displacement. All data showed a high degree of reproducibility and marked similarity of general pattern over a Reynolds number range of 2500 to 7000. Within the limits of the sensitivity of the equipment, turbulent fluctuations of velocity were shown to exist in a region much closer to the tube wall than the thickness of the so-called laminar sublayer. To determine the effects of roughness, flow studies were made in a one-half inch diameter Al tube with eighteen 0.039-in. deep internal threads per inch of length and in a one-half inch diameter glass tube, internally "frosted" by grinding with carborundum powder. Results of these runs indicate that the effect of the roughness does not extend more than a very short distance into

the main fluid stream. The effect of vibration was observed by superposing a pulse of 1200 to 1500 cycles per minute on the flowing fluid in the column. Results of the runs were inconclusive; except for minute fluctuations in the transmission data, there was no visible effect on the parabolic velocity pattern. Several runs were attempted in which the mass transfer effects were enhanced by a high concentration gradient between the displaced and the displacing fluids. In these runs, a modified plug-type flow was obtained due to density differences, heat effects, and interfacial tension as well as to mass transfer. Data on non-Newtonian flow were obtained using a 3% aqueous bentonite suspension. Evidence was obtained of anomalous behavior very close to the tube wall, but the data on the fluid properties are inadequate to permit quantitative interpretation. The application of the radio-tracer displacement technique to non-Newtonian flow will probably prove to be a most important one since other techniques for measuring local velocities are almost useless with these materials. An appendix is included listing the various runs which have been made in each of the several categories of tests. (auth)

1040 WIAP-4

Westinghouse Electric Corp. Industrial Atomic Power Group, Pittsburgh.

HYDRAULIC ASPECTS OF FLUID FLOW THROUGH PACKED AND FLUIDIZED SYSTEMS. N. A. Beldecos, J. D. Lokay, and A. K. Smith. Oct. 15, 1953. Changed from OFFICIAL USE ONLY May 17, 1956. 31p. $6.30 (ph OTS); $3.00(mf OTS).

A correlation and summary of the results of investigations of fluid flow through packed and fluidized systems are presented. The information should be useful to design engineers. (T.R.H.)

1041 WIAP-M-24

Westinghouse Electric Corp. Industrial Atomic Power Section, McKeesport, Penna.

THERMODYNAMIC INVESTIGATION OF THE BENZENE TURBINE CYCLE. N. A. Beldecos and J. D. Lokay. July 5, 1953. 27p. $0.25(OTS).

A thermodynamic investigation of the benzene turbine cycle for use in reactors utilizing liquid Na, was made. The optimum locus of throttle pressure-temperature combinations which might be considered for use in a benzene turbine cycle was indicated. It was felt that the improvement of 7% in the benzene cycle efficiency is not sufficient to justify the adoption of the higher pressure-temperature combination. (F.S.)

1042 WIAP-M-38

Westinghouse Electric Corp. Industrial [Atomic Power] Group, Pittsburgh.

BASIC EQUATIONS AND DATA FOR THE EVALUATION OF HEAT TRANSFER SURFACE REQUIREMENTS AND PRESSURE DROP OF PRESSURIZED WATER TO STEAM HEAT EXCHANGERS. Arthur K. Smith. June 24, 1954. 49p. $7.80(ph OTS); $3.30(mf OTS).

Factors influencing the design of shell and tube type of heat exchangers with separate preheater and evaporator sections are discussed. Basic equations relating to the heat transfer coefficients and the heat balance are given. Data on standard tube sizes, thermal conductivity of tube materials, and physical properties of water are provided for the evaluation of heat exchangers. Equations are provided for calculating the pressure drop across the heat exchanger and for defining the optimum velocity of coolant in the tubes of the exchanger. (J.H.M.)

1043 TT-626

THE CONTRIBUTION OF RADIATION TO HEAT CONDUCTION. E. F. M. Van der Held. Translated by H. A. G. Nathan from Centr. Tech. Inst. T. N. O. Delft afd. Warmtetech. Verslag 37, 1955; also published in Electro-techniek 33, 278-82(1955). 15p.

Data are presented on both stationary and transient methods for the measurement of thermal properties. The role of radiation in heat conduction is discussed in relationship to heat flow in building materials. (C.H.)

1044

SOLAR FURNACE IN HIGH-TEMPERATURE RESEARCH. Tibor S. Laszlo. Science 124, 797-800(1956) Oct. 26.

Advantages of the solar furnace for studies in the field of high-temperature research are discussed. (C.H.)

1045

HEAT-CONDUCTION METHODS IN FORCED-CONVECTION FLOW. S. Levy (General Electric Co., Schenectady, N. Y.). Trans. Am. Soc. Mech. Engrs. 78, 1627-35(1956) Nov.

Transient heat-conduction solutions are used to determine the thermal characteristics of fluid flowing in circular conduits, annuli, and between parallel plates. Jaeger's method of deriving the time lag for heat conduction in composite slabs (herewith extended to include composite cylinders) reduces the problem to a series of arithmetical calculations. Numerical results are presented for flow between parallel plates with the following boundary conditions: Constant heat rate, linear wall-temperature variation, and constant wall temperature at one of the external surfaces with constant heat rate, no heat transfer, or zero temperature at the other surface. Some solutions are extended to account for external wall resistance, and thermal entry lengths are evaluated for fluids with high or low Prandtl numbers. (auth)

1046

METHODS OF CALCULATIONS FOR HEAT EXCHANGE AND HYDRAULIC RESISTANCE IN HIGH SPEED GAS FLOW. P. V. Dvornichenko. Zhur. Tekh. Fiz. 26, 1571-8(1956) July. (In Russian)

Refer also to abstract 1236.

MATERIALS TESTING

1047 AD-94819

Parsons Corp., Traverse City, Mich.

TABULATION OF FATIGUE TEST DATA USING IBM COMPUTING TECHNIQUES. Summary of Phase I. A. J. Belfour. Apr. 27, 1956. 12p. Contract AF33(616)-3301. (M-332-3).

A system was developed for tabulating fatigue test data from published reports. The tabulated data are in a form that can be readily punched on IBM cards for further processing and analysis. (F.S.)

1048 AD-94820

Parsons Corp., Traverse City, Mich.

INSTRUCTIONS FOR TABULATING FATIGUE TEST DATA FOR ENTRY OF IBM PUNCH CARDS. A. J. Belfour. Apr. 27, 1956. 12p. Contract AF33(616)-3301. (M-332-4).

The system to be used in preparing fatigue test data for entry on IBM punch cards is demonstrated. (F.S.)

1049 AECU-3150

Franklin Inst. Labs. for Research and Development, Philadelphia.

LOAD CAPACITY AND DRY FRICTION TESTS OF A WATER-LUBRICATED THRUST BEARING. Final Report [for] February 19, 1954 to August 31, 1954. Stanley Abramovitz. 23p. For Westinghouse Electric Corp. Subcontract 57-(14-371). (F-2437). $0.25(OTS).

Tests were made with a tilting-pad thrust bearing designed to operate with water as its lubricant. The load capacity tests indicated the ability of the bearing to maintain a full fluid film under 100 psi unit load when the proper shoe-face curvature was imposed. Dry friction tests at various speeds resulted in no harmful bearing-surface effects when the bearing was operated for a five-minute period. (auth)

1050 AECU-3269

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

"FROZEN STRESS" PHOTOELASTIC ANALYSIS OF STRESS IN STR CORE NO. 4 MARK 1 REPLACEMENT HEAD. Research Report 100FF971-R2. R. C. Sampson and M. M. Leven. Feb. 3, 1956. 16p. For Westinghouse Electric Corp.. Bettis Plant. Contract AT-11-1-GEN-14, CG 20000, 25b25. $3.30(ph OTS); $2.40(mf OTS).

A photoelastic model analysis of stress in the STR Core No. 4 Mark 1 replacement head was made in order to predict prototype elastic stresses due to internal pressure. The highest tensile stresses were found at the top surface on the boundary of the central hole piercing the head. Stress peaks of lower magnitude were found at points on the other hole boundaries and on the toroidal inner surface of the head. (auth)

1051 WADC-TR-54-270(Pt. 2)

Cornell Aeronautical Lab., Inc., Buffalo.

INVESTIGATION OF THE COMPRESSIVE, BEARING, AND SHEAR CREEP-RUPTURE PROPERTIES OF AIRCRAFT STRUCTURAL METALS AND JOINTS AT ELEVATED TEMPERATURES. [Period covered] December 1953 to December 1954. Frank J. Vawter, Glen J. Guarnieri, Luke A. Yerkovich, and George Derrick. Sept. 1956. 94p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF33(616)-190. (AD-97283).

The establishment of high-temperature creep and rupture properties of materials is a prerequisite for design if exposure to elevated temperature in service is anticipated. These properties, which are determined from the conventional tensile creep test, are of questionable value if stress conditions other than tension are encountered. To supplement these existing tensile creep and rupture data, this project was initiated to determine the high-temperature creep strengths of a number of structural aircraft alloys when subjected to compression, bearing, and shear stresses. Tensile creep data are included for A-70 commercially-pure Ti, C-110M Ti alloy and SAE 4130 alloy steel sheet. Bearing creep data are presented for A-70 and C-110M Ti, 4130 steel and type 321 stainless steel. In addition, results of shear-pin deformation tests on 2117-T4 Al, Monel and type 301 stainless steel wire and compression creep test results for 2024-T3 Al sheet and plate and C-110M Ti alloy sheet are included. (See also WADC-TR-270 (Pt. 1)). (auth)

1052 WADC-TR-54-531

Curtiss-Wright Corp. Propeller Div., Caldwell, N. J.

INVESTIGATION OF MATERIALS FATIGUE PROBLEMS APPLICABLE TO PROPELLER DESIGN. [Period covered] May 4, 1953 to April 1, 1955. H. N. Cummings, F. B. Stulen, and W. C. Schulte. May 1955. 194p. Project title: PROPELLER BLADES. Task title: INVESTIGATION OF THE STATISTICAL NATURE OF FATIGUE. Contract AF33(616)-493. (AD-69981).

SAE 4340 steel, aircraft quality, from a single heat, at three high-hardness levels, was tested in rotating bending, and statistically determined S-N curves of constant probability of strength for smooth and for notched specimens were established. In addition, exploratory tests were made, by the Prot method, on the 4340 steel, and, by conventional methods, on ultra-high strength 4350 steel, for the mean endurance limit. The effect of inclusions on fatigue strength was studied, not only for the above tests but also for a small lot of vacuum-melted "inclusion-free" steel. A preliminary study was made of the possibility of using ultrasonic techniques for locating and measuring inclusions, and for detecting and measuring early fatigue cracks. (auth)

1053 WADC-TR-55-86[(Pt. 1)]

Minnesota. Univ., Minneapolis.

FATIGUE CRACK DETECTION METHODS. L. J. Demer. Jan. 1955. 64p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE PROPERTIES OF STRUCTURAL MATERIALS. Contract AF33(038)-20840. (AD-61308).

The factors involved in fatigue crack detection are discussed and the various nondestructive and destructive methods available for the purpose are described. Emphasis is placed on the use of these in laboratory fatigue tests on machined specimens. Numerous references are given both to literature dealing with the methods themselves and to investigations in which these methods have been employed. A critical evaluation is made of the various methods and the characteristics of each are set forth. (auth)

1054 WAPD-PWR-FE-1134

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EDDY-CURRENT TESTING OF ZIRCALOY TUBING. H. M. Schadel, Jr. Dec. 8, 1955. 34p. $6.30(ph OTS); $3.00(mf OTS).

Extensive tests were run with the 1-kc Probolog to determine applicability of that eddy-current equipment for production testing of Zircaloy-2 tubing for use in PWR fuel elements. An evaluation was made of the effects of residual cold work, hardness, wall thickness, transverse and longitudinal flaws, holes, laps, and foreign material on the recorded trace. An inspection criteria is presented which permits the rapid detection of approximately 85% of the flaws. An undetermined number of these flaws would not have been found by any other means or would not have been found as quickly or as economically by the other means. (auth)

1055

SHOCK WAVES IN A PLASTIC COMPRESSIBLE MEDIUM. A. S. Kompaneets (Inst. of Chemical-Physics, Acad. of Science S.S.S.R.). Doklady Akad. Nauk S.S.S.R. 109, 49-52 (1956) July 1. (In Russian)

1056

SOME NONDESTRUCTIVE TESTING METHODS FOR TESTING WELDS. W. J. McGonnagle (Argonne National Lab., Lemont, Ill.). Welding J. (N. Y.) 35, 1110-19(1956) Nov.

The sensitivity, advantages, disadvantages and limitations of thermal testing, radiography, penetration inspection, eddy currents and ultrasonics and techniques for these nondestructive testing methods are discussed. (F.S.)

PUMPS

1057 AERE-R/R-1977

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RIG FOR THE MEASUREMENT OF RADIAL LOAD ON SMALL CENTRIFUGAL PUMP IMPELLERS. A. P. Coggon. Apr. 1956. 20p.

The design of a rig for measurement of the load on the

bearings of a given impeller and volute design while in operation is given. Hydraulic performance and efficiency may also be determined. (T.R.H.)

1058 IGR-R/CA-184

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
DESIGN AND DEVELOPMENT OF A VARIABLE-FLOW CENTRIFUGAL PUMP FOR ALKALINE SOLUTIONS. A. Barker and F. McKay. Aug. 23, 1956. 11p.

A centrifugal pump for alkaline solutions at a head of 54 inches, with variable flow rates up to 24 cm^3/sec is described. It responds automatically to changes in flow without appreciable change in liquid level at the pump intake. The design and its characteristics are given. (T.R.H.)

1059 ORNL-2175

Oak Ridge National Lab., Tenn.
USE OF AN AIR LIFT AS A METERING PUMP FOR RADIOACTIVE SOLUTIONS. G. W. T. Kearsley. Oct. 30, 1956. 35p. Contract W-7405-eng-26. $0.30(OTS).

Performance tests have shown that small quantities of radioactive feed solutions may be pumped successfully with an air lift and that the pumping rate can easily be kept within 5% of any preset value. Air lifts were tested with columns ranging from 0.18 to 1 in. in inside diameter, with water, NaCl solution of specific gravity 1.12, and $UO_2(NO_3)_2$ solution of specific gravity 1.45. Variables studied were diameter, height, and submergence of the columns; density, viscosity, and surface tension of the pumped liquid; back pressure on the system; presence of suspended solids in the system; and the humidity of the operating air. Derivations of simple equations are given, and the results are presented in tabular and graphic form. (auth)

1060 UCRL-3194

California. Univ., Berkeley. Radiation Lab.
THE TECHNOLOGY OF LARGE MERCURY-PUMPED VACUUM SYSTEMS. Hugh R. Smith. Nov. 9, 1955. 41p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

Certain types of special-purpose vacuum systems require a higher order of cleanliness than can be obtained with oil diffusion pumps. Ionization pumps of one form or other appear promising for small-volume or sealed-off systems. For large continuously pumped systems, Hg diffusion pumps provide the only presently practical means of achieving low pressures without contamination by migration of organic materials. The vacuum design considerations of large systems involving the application of 8-in. through 32-in. Hg diffusion pumps are considered. The selection, rating, and optimization of pumps are discussed along with the closely allied problem of baffling the pumps. The materials of construction and methods of fabrication to avoid subsequent system contamination are dealt with in detail. System interlocking and its associated instrumentation are illustrated by referral to the operation of a large particle-accelerator vacuum system. (auth)

1061 WIAP-M-30

Westinghouse Electric Corp. Industrial [Atomic Power] Group, Pittsburgh.
A 50 KW DC ELECTROMAGNETIC PUMP FOR LIQUID METAL APPLICATION. A. R. Jones. [1953?]. Changed from OFFICIAL USE ONLY May 17, 1956. 17p. $3.30 (ph OTS); $2.40(mf OTS).

The results of the study and design of a pump to handle three thousand gallons per minute of liquid Na at 600°F pumping against a developed head of 100 ft. While Na and the other liquid metals do not differ radically from water in density or viscosity they do have certain characteristics which indicate changes in the component designs in systems for their handling. (auth)

RADIOGRAPHY

1062 AD-94449

Detroit Arsenal, Center Line, Mich.
A PROGRAM TO PRODUCE STANDARD COMPARISON RADIOGRAPHS OF VARIOUS CASTING AND WELD DEFECTS. Report No. 3524 (Final). W. F. Wulf. Apr. 23, 1956. 24p.

Nineteen experimental radiographs were made of a typical centerline shrinkage defect using 250-kv, 1000-kv, and 15-Mev radiation. The test results revealed a considerable variation in film contrast between the three leve of radiation. Each test film was evaluated by determining the contrast ratio between the background density and the defect area density. (auth)

1063 WAPD-PWR-FE-1228

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE RADIOGRAPHIC INSPECTION OF PWR FUEL ROD END CLOSURES. D. M. McCutcheon and A. E. Oaks. Mar. 24, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

Studies were made on various methods of improving radiographic sensitivity for the inspection of PWR fuel rod end closures. From these, a process specification embodying the best techniques developed to date, was written. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1064 AERE-M/R-1934

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A PRELIMINARY STUDY OF THREE CERMETS BASED ON URANIUM OXIDE. L. S. Williams, D. T. Livey, E. Barnes, and P. Murray. May 4, 1956. 30p.

The fabrication and some properties of three cermets were investigated in outline. Fabrication by hot pressing methods is feasible provided an A atmosphere is used. The thermal shock properties of UO_2 are not improved by the addition of Zr; however the UO_2–Th system, at high metal contents, and to a lesser extent the UO_2–Si system, up to 60 vol. % of metal, show improvement in this respect. The poor properties of the Zr cermets is probably due to O embrittlement of the Zr as a result of reaction with the oxide constituent. The use of Si as the metallic constituent at 20% by volume improves the oxidation resistance of UO_2 in air at temperatures up to 900°C. Addition of silicon beyond 20 vol. % has little effect on the rate of oxidation. (auth)

1065 NACA-TN-1911

Lewis Flight Propulsion Lab., Cleveland.
PHYSICAL PROPERTIES AT ELEVATED TEMPERATURE OF SEVEN HOT-PRESSED CERAMICS. James J. Gangler, Chester F. Robards, and James E. McNutt. Mar. 1, 1949. 33p.

Presents investigation to determine elevated temperature, short-time tensile strength, relative resistance to thermal shock, coefficient of thermal expansion, and density of seven ceramics fabricated by hot-pressing. Ceramics are boron carbide, titanium carbide, zirconium carbide, 85% silicon carbide plus 15% boron carbide, magnesium oxide, zircon, and stabilized zirconia. Titanium carbide was the most promising of the seven ceramics for possible gas-turbine application because of high tensile

strength at elevated temperatures and its superior resistance to thermal shock. (auth)

1066

MONOCRYSTALS OF SOLID SOLUTIONS OF BARIUM AND STRONTIUM TITANATES; THEIR PREPARATION AND DIELECTRIC AND OPTICAL PROPERTIES. A. L. Khodakov, M. L. Sholokhovich, E. G. Fesenko, and O. P. Kramarov. (Molotov, Rostov-on-Don State Univ.). Doklady Akad. Nauk S.S.S.R. 108, 825-8(1956) June 11. (In Russian)

Investigations revealed continuous series of solid solutions of (Ba−Sr)TiO_3 formed in the $BaTiO_3$−$SrTiO_3$ system at 1350° which were retained at room temperature and did not decompose in potassium fluoride fusion. Consequently, the crystallization surface of K_2F_2−$BaTiO_3$ which was the cross section of the complex multi-component system K, Ba, Sr//TiO_3, consisted of only two phases, the phase of potassium fluoride which occupied a negligible part of the crystallization surface and the phase of solid solutions of (Ba−Sr)TiO_3 which filled in the rest. Monocrystals of the solid solutions (Ba−Sr)TiO_3 contained from 5 to 50% $SrTiO_3$ (molecular %). Dielectric density and the tangent of the loss angle were studied at the temperature range from −160 to +150°. Dielectric and optical characteristics of the monocrystals and radiographic density are tabulated. (R.V.J.)

1067

X-RAY STUDIES OF RECRYSTALLIZATION OF HIGH MELTING COMPOUNDS. S. S. Gorelik and Ya. S. Umanskiĭ (Stalin Moscow Inst. of Steel). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 650-2(1956) June. (In Russian)

X-ray studies were made of WC and NiAl compounds at high annealing temperatures. Diagrams and tabulations are given of the high annealing temperature effect on the starting point of recrystallization and rest of the prepared specimens of WC and NiAl compounds. (R.V.J.)

1068

EFFECT OF POROSITY ON PHYSICAL PROPERTIES OF SINTERED ALUMINA. R. L. Coble and W. D. Kingery (Massachusetts Inst. of Tech., Cambridge). J. Am. Ceram Soc. 39, 377-85(1956) Nov.

Porous structures having a continuous solid phase with isolated pores were prepared by the addition of different amounts of crushed naphthalene to an alumina casting slip. Samples of from 5 to 50% porosity were fired together for comparable grain development, eliminating structural variables except porosity. Effects of porosity and temperature on strength, elastic modulus, modulus of rigidity, and coefficient of thermal expansion were investigated. Effects of porosity on thermal stress resistance and torsional creep properties were studied at constant temperature. (auth)

1069

SURFACE TENSION OF SIMPLE OXIDE SYSTEMS. S. I. Popel and O. A. Esin (Kiror Urals Polytechnic Inst.). Zhur. Fiz. Khim. 30, 1193-1201(1956) June. (In Russian)

The surface tension of the FeO−Fe_2O_3, FeO−Fe_2O_3−SiO_2, FeO−MnO−SiO_2, FeO−CaO−Fe_2O_3, FeO−Na_2O, and FeO−CaO−SiO_2 systems at 1300 to 1400° has been determined by the maximum bubble pressure method. It has been revealed that Fe_2O_3 is the capillary-active component of the system FeO−Fe_2O_3. The capillary activity of Na_2O was established in the FeO−Na_2O−Fe_2O_3 and CaO in the alloys of FeO−CaO−Fe_2O_3. The gradual decrease of the surface tension with the increase of the content of silica in the MnO−SiO_2 and FeO−SiO_2 previously established by the "ring" method, has been confirmed. The relationship obtained has been explained qualitatively in terms of the change in the potential energy of ionic interaction. (tr-auth)

1070

REGULARITIES AND MECHANISMS OF OXIDATION OF HARD, HIGH MELTING POINT TITANIUM COMPOUNDS. G. V. Samsonov and N. K. Golubeva (Kalinin Moscow Inst. of Nonferros Metals and Gold). Zhur. Fiz. Khim. 30, 1258-66(1956) June. (In Russian)

Oxidation isotherms of dense compact samples of TiC and TiN were found to consist of two regions, the initial curved one and the subsequent linear domain while the TiB follows the hyberbolic law. Studies were made by chemical, x-ray, and electron diffraction methods of oxide films and their structure and electrical resistance. During the initial period of oxidation (the curved part of isotherm) a dense film of TiC−TiO or TiN−TiO is formed on titanium carbides and nitrides which is followed, in the second period, by the formation of less compact layers of higher oxides of Ti. The oxidation of TiB occurs at the expense of the oxygen diffusion through the layer of borates formed on the surface. (tr-auth)

1071

DIELECTRIC PROPERTIES OF SOME SOLID SOLUTIONS CONTAINING BARIUM TITANATES. N. S. Novosil'tsev and A. L. Khodakov. Zhur. Tekh. Fiz. 26, 310-22(1956) Feb. (In Russian)

Studies were made of the solid solutions of barium titanates with various secondary components, and their dielectric penetration properties, electroconductivity, and losses with variations of temperature are described. It is shown that the temperature interval of the tetragonal phase can be expanded or reduced by adding suitable compounds. (R.V.J.)

Refer also to abstract 968.

CORROSION

1072 AECU-3151

Ionics, Inc., Cambridge, Mass.

PRESSURIZED LOOP MEMBRANE DEMINERALIZER TESTS. Final Report [for] January−June 1953. N. W. Rosenberg. Sept. 15, 1954. 10p. [For Westinghouse Electric Corp. Atomic Power Div.] Subcontract 14-316. $1.80(ph OTS); $1.80(mf OTS).

A membrane demineralizer has been tested in a pressurized loop. The loop water resistivity was maintained in the 1 to 2 megohm range by ionized solid transfer in the demineralizer. The size and power requirements of the unit tested, per gpm flow through the unit, were 2.3 ft^3 and 100 watts. In view of the fact that present designs could reduce the size and required maintenance, further studies may be warranted. (auth)

1073 AECU-3260

Westinghouse Electric Corp. [Bettis Plant,] Pittsburgh.

CORROSION TESTING OF ZIRCONIUM, ZIRCALOY AND HAFNIUM. J. S. Theilacker. Mar. 9, 1956. Revised May 26, 1956. 6p. (PS-AP-292494). $1.80(ph OTS); $1.80(mf OTS).

Specifications for governing the corrosion testing of Zr, Zircaloy, and Hf are discussed. (J.H.M.)

1074 CF-56-1-21

Oak Ridge National Lab., Tenn.

ATTACK OF CIRCULATING AQUEOUS−ThO_2 SLURRIES ON STAINLESS STEEL SYSTEMS. D. G. Thomas. Jan. 5, 1956. Decl. Nov. 2, 1956. 64p. Contract [W-7405-eng-26]. $0.50(OTS).

An analysis of the attack rate data obtained while operating the 100A loops S and T, with thorium oxide slurries is presented. Data from the literature on the

attack rate of slurries are also presented which supplements the results from S and T loop. Attack rates for these specific systems and where possible, the relative contributions of different variables to the over-all attack rate were established. By establishing the trends and the relative importance of the different variables it should be possible to set the operating conditions for a slurry system to give a minimum attack rate. And if, as is entirely probable, conditions giving minimum attack rate are not those found most desirable to minimize the handling or caking problems, the attack rate for various compromise conditions can be estimated and the most satisfactory one chosen. (auth)

1075 JPL-PR-26-2

California Inst. of Tech., Pasadena. Jet Propulsion Lab.
CORROSION AND IGNITION OF TITANIUM ALLOYS IN FUMING NITRIC ACID. II. STUDY OF ADDITIONAL CHEMICAL AND METALLURGICAL FACTORS. Progress Report. John B. Rittenhouse, Stephen P. Vango, and Julia S. Whittick. Nov. 30, 1955. 36p. Contract AF33 (616)-3066.

The corrosion product removed from commercially pure Ti after exposure to 20% NO_2 anhydrous fuming HNO_3 was found by x-ray diffraction and chemical analysis to be Ti metal. Metallographic observations indicate that the possible mechanism of corrosive attack of the fuming HNO_3 on Ti and Ti alloys is through intergranular corrosion of the all-alpha or all-beta Ti alloys. Similar observations of the mixed alpha-beta alloy indicate a possible galvanic or electrochemical mechanism of the attack by liquid-phase HNO_3 acid. (For preceding period see JPL-26-1.) (auth)

1076 LA-1959

Los Alamos Scientific Lab., N. Mex.
OXIDATION OF METALS SUBJECTED TO AN INCREASING REACTION TEMPERATURE. James T. Waber and Robert Kleinberg. Aug. 1955. 16p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

A mathematical analysis has been completed of the amount of oxide formed when a metal is subjected to increasing temperature. Some generality has been achieved in the analysis by assuming that (1) the temperature increases according to T^n, (2) the growth of the oxide follows the power law $m^\nu = k_p t$, and (3) the surface coverage of adsorbed atoms is given by the generalized Langmuir adsorption isotherm $K[O]^{1/\gamma} \{1 + K[O]^{1/\gamma}\}^{-1}$. The resulting integrals are reduced to incomplete gamma functions. The implications of this more general form of Langmuir's equation are discussed. (auth)

1077 NRL-4838

Naval Research Lab., Washington, D. C.
ALUMINUM COATINGS ON STAINLESS STEEL. J. E. Srawley. Sept. 5, 1956. 41p. Project No. NS 024-002.

A limited investigation of the resistance of aluminum-coated, type 310 stainless steel to attack by fuel-ash constituents has been carried out. The coatings were applied in the laboratory by hot-dipping and were subsequently processed by heat treatment. Within the limitations of the experimental procedures, which were confined to a testing temperature of 1700°F, the coated specimens did not exhibit substantially better resistance than the uncoated steel. Variations in heat treatment, including the use of a recommended procedure, had little effect on resistance. The requirements of more decisive methods of evaluating the resistance of materials to fuel-ash attack became apparent during the study. Further work on the constitution and structure of aluminum coatings would be justified only if positive evidence of their value were to be obtained by such methods. (auth)

1078 WAPD-MDM-11

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE OXIDATION OF ZIRCONIUM AND ZIRCONIUM ALLOYS IN AIR. H. R. Hoge. May 24, 1954. Changed from OFFICIAL USE ONLY July 18, 1956. 29p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

Data are presented to determine the practical limit for heating strip Zr and its alloys in air. Tests show that the rate of oxidation at higher temperatures increases rapidly, and it is not practical to heat Zr or Zr alloy strip in air above 1500°F. (J.H.M.)

1079

THE ELECTRODE POTENTIAL OF THE OsO_2—OsO_4 COUPLE. G. H. Cartledge (Chemistry Div., Oak Ridge National Lab., Oak Ridge, Tenn.). J. of Chem. Phys. 60, 1468-70(1956) Oct.

The electrode potential of the OsO_2–OsO_4 (aq.) couple at 24.5° is determined to be −0.964 ± 0.002 v. The data are of use in a study of the passivation of Fe by OsO_4. (T.R.H.)

1080

INVESTIGATIONS OF CORROSION RESISTANCE IN SOLID METALLIC SOLUTIONS. II. Mg–Cd ALLOYS. N. N. Gratsianskiĭ and P. F. Kalyuzhnaya (Kiev Inst. of General and Inorganic Chemistry). Zhur. Fiz. Khim. 30, 1267-77 (1956) June. (In Russian)

The resistance of two structural types of Mg–Cd solid solutions to corrosion in 1.0N H_2SO_4 and 5% NH_4Cl at 16 and 40° has been investigated. Measurements were made of the potentials of the corroding alloys. The corrosion stability limits of the alloys, determined by weighing appear on the composition-corrosion-stability diagrams in concentrations below 75 at. % Mg. The curves show the potentials of corroding alloys changing with the composition without any sharp breaks. The loose textured layer on the alloy surface measured by microhardness method increased after corrosion from 1 to 2 μ to 3 to 4 μ. (tr-auth)

GEOLOGY AND MINERALOGY

1081 CEA-498

France. Commissariat a l'Énergie Atomique, Paris.
CONTRIBUTION TO THE GEOLOGY OF THE NIARI BASIN; SEDIMENTOLOGY AND METALLOGENY OF THE MINING REGION. (Contribution à la Géologie du Bassin du Niari; Sedimentologie et Metallogénie de la Region Miniere). Georges Bigotte. 1955. 265p., 11 illus.

Thesis submitted to the Univ. of Nancy.

1082 RME-1076

Denver Area Office, AEC.
LOCATION OF URANIUM DEPOSITS IN SOUTHWESTERN NORTH DAKOTA AND THE CAVE HILLS AND SLIM BUTTES AREAS, HARDING COUNTY, SOUTH DAKOTA. July 1956. 12p. $0.15(OTS).

The three maps and accompanying lists which constitute this report give the location of uranium deposits containing more than 0.10 percent U_3O_8. Property names and locations by section, township and range are listed. In Billings County, southwestern North Dakota, uranium occurs in lignite or lignitic shales. In the Cave Hills and south Slim Buttes areas, Harding County, South Dakota, uranium occurs primarily in lignite, and also is found in mudstone and sandstone deposits. The names and locations of deposits outside the map areas are listed. (auth)

1083

KUPLETSKIT—NEW MINERAL OF ASTROPHYLLITE GROUP. E. I. Semenov (Lab. of Mineralogy and Geochemistry of Rare Elements). Doklady Akad. Nauk S.S.S.R. 108, 933-6(1955) June 11. (In Russian)

A new mineral of the Mn astrophyllite group was found in the Kol'skiĭ peninsula in 1949. It is blackbrown in color, vitreous, hardness of 3, specific weight 3.201 (sample 1) and 3.229 (sample 2), melts at a temperature of 740 to 800°, easily dissolved in acid, and slightly magnetic. The chemical analysis of the mineral is given. (R.V.J.)

1084

MINERALOGY AND PARAGENESIS OF THE URANIUM ORE, MI VIDA MINE, SAN JUAN COUNTY, UTAH. Eugene B. Gross. Econ. Geol. 51, 632-48(1956) Nov.

Ore at the Mi Vida mine, San Juan County, Utah, consists of uraninite, coffinite, montroseite, a new vanadium oxide mineral, corvusite, and minor secondary minerals. The ore occurs within the matrix of the lower Chinle calcareous sandstones and conglomerates, which are colored dark gray to black by ore minerals and carbonaceous material. The primary ore minerals fill interstices in the sandstone and replace calcite and fossil wood. The replacement process was partly selective: much uraninite replaced carbonaceous debris, calcite, and detrital grains, and the vanadium minerals principally replaced calcite of the sandstone matrix. A few sulfides, pyrite, galena, and greenockite, appeared at the same time or slightly later than the primary ore. Replacement textures are common in the ore, but age relations are not clear in all cases. (auth)

1085

BRANNERITE FROM RAJASTHAN. G. V. Umamaheswararao and R. Krishnaswamy (Atomic Energy Establishment, Bombay). J. Sci. Ind. Research (India) 15A, 401-2(1956) Sept.

The occurrence of a titanium-bearing uranium mineral, brannerite, in Rajasthan, India is reported. Data are presented on the physical properties, optical properties, chemical composition, and x-ray-powder diffraction pattern. (C.H.)

1086

BOLTWOODITE, A NEW URANIUM SILICATE. Clifford Frondel (Harvard Univ., Cambridge, Mass.). Science 124, 931(1956) Nov. 9.

The mineral, boltwoodite, was found during a study of the mineralogy of the Delta Mine, familiarly known as Pick's Mine, on the western edge of the San Rafael Swell, Emery County, Utah. Chemical analysis and a spectrographic study prove the substance to be a potassium uranyl silicate near $K_2(UO_2)_2(SiO_3)_2(OH)_2.5H_2O$ in ratios. It is the only uranyl silicate known that contains an alkali as an essential cation. X-ray powder diffraction study suggests a structural relation to sklodowskite, $Mg(UO_2)_2(SiO_3)_2(OH)_2.5H_2O$. Single-crystal x-ray and morphological study was precluded by the small size of the crystals. (auth)

1087

SOME URANIUM OCCURRENCES IN WEST TEXAS. D. Hoye Eargle. Univ. Texas Bur. Econ. Geol. Rept. Invest. No. 27, Sept. 1956. 23p.

Uranium minerals have been found at several localities in west Texas. In the King Mountain area in southwestern Upton County carnotite forms coatings along joint planes and in borings in marine Cretaceous limestone. In the Hueco Mountains area in El Paso and Hudspeth counties carnotite and similar secondary uranium minerals form coatings in caliche and colluvium of Pleistocene(?) or Recent age, and along joints and bedding planes in limestone of Permian age. No uranium ore has been produced, however, from either area. In the King Mountain area, coatings of carnotite and tyuyamunite have been observed from about 2 feet to a maximum of $7\frac{1}{2}$ feet below the surface of the ground in the Edwards limestone of Early Cretaceous age. One channel sample of the limestone in this area contained 0.002 percent U and 0.004 percent eU, and a small, selected sample of the mineral coatings contained 8.52 percent U and an estimated 3.7 percent eU. In the Hueco Mountains area, coatings of carnotite and tyuyamunite have been found on boulders in colluvial deposits, on fractures in a caliche matrix of the colluvium, and on joints and bedding planes in the underlying Hueco limestone of Permian age. In the colluvium, the coatings have been found to depths of 20 feet below the surface, and in the Hueco limestone they extend to depths of 12 to 15 feet below the surface, maximum depths penetrated by the prospect pits. Selected samples from the colluvial deposits contained as much as 0.01 percent eU and 0.023 percent U. Uranium minerals are reported in other widely scattered prospect pits along the west side of the Hueco Mountains. In both areas the minerals seem to have been deposited from surficial waters and are found in a zone generally less than 20 feet below the surface of the ground. Analyses show that in both areas the uranium is out of equilibrium with its decomposition products and that the chemical uranium is greater than the equivalent uranium, suggesting that the mineralization may be relatively recent. (auth)

1088

PRELIMINARY GEOLOGIC MAP OF THE GAS HILLS URANIUM DISTRICT, FREMONT AND NATRONA COUNTIES, WYOMING. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-83. H. D. Zeller, P. E. Soister, and H. J. Hyden. Washington, U. S. Geological Survey, 1956. $0.75.

1089

PHOTOGEOLOGIC MAP OF THE WHITE CANYON-4 QUADRANGLE, SAN JUAN AND GARFIELD COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-170. P. P. Orkild. Washington, U. S. Geological Survey, 1956. $0.50.

1090

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-4 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-172. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

1091

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-6 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-173. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

1092

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-8 QUADRANGLE, SAN JUAN COUNTY, UTAH, AND MONTROSE COUNTY, COLORADO. MISCELLANEOUS GEOLOGICAL INVESTIGATIONS MAP I-174. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

1093

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-16 QUADRANGLE, SAN JUAN COUNTY, UTAH AND SAN MIGUEL COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-176. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

1094

PHOTOGEOLOGIC MAP OF THE EMERY-8 QUADRANGLE, EMERGY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-177. W. H. Condon. Washington, U. S. Geological Survey, 1956. $0.50.

1095

PHOTOGEOLOGIC MAP OF THE ORANGE CLIFFS-13 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-178. R. G. Ray. Washington, U. S. Geological Survey, 1956. $0.50.

1096

PHOTOGEOLOGIC MAP OF THE VIRGIN SE QUADRANGLE, WASHINGTON COUNTY, UTAH AND MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-179. C. L. Pillmore. Washington, U. S. Geological Survey, 1956. $0.50.

1097

PHOTOGEOLOGIC MAP OF THE CARLISLE-1 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-180. G. E. Tolbert. Washington, U. S. Geological Survey, 1956. $0.50.

1098

PHOTOGEOLOGIC MAP OF THE BLUFF-3 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-181. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

1099

PHOTOGEOLOGIC MAP OF THE PARIA PLATEAU NW QUADRANGLE, CONCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-182. J. P. Minard. Washington, U. S. Geological Survey, 1956. $0.50.

1100

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-7 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-183. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50

1101

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN-13 QUADRANGLE, KANE AND SAN JUAN COUNTIES, UTAH AND COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-184. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

1102

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN-15 QUADRANGLE, SAN JUAN COUNTY, UTAH AND NAVAJO COUNTY ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-185. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

1103

PHOTOGEOLOGIC MAP OF THE TIDWELL-10 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-186. A. B. Olson. Washington, U. S. Geological Survey, 1956. $0.50.

1104

PHOTOGEOLOGIC MAP OF THE ORANGE CLIFFS-11 QUADRANGLE, WAYNE AND GARFIELD COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-187. R. G. Ray. Washington, U. S. Geological Survey, 1956. $0.50.

1105

PHOTOGEOLOGIC MAP OF THE ORDERVILLE CANYON NW QUADRANGLE, KANE AND WASHINGTON COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-188. C. L. Pillmore. Washington, U. S. Geological Survey, 1956. $0.50.

1106

PHOTOGEOLOGIC MAP OF THE LEES FERRY SW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-189. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

1107

PHOTOGEOLOGIC MAP OF THE EMMETT WASH NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-190. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

1108

PHOTOGEOLOGIC MAP OF THE PARIA PLATEAU SE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-191. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

1109

PHOTOGEOLOGIC MAP OF THE EMMETT WASH NW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-192. J. P. Minard. Washington, U. S. Geological Survey, 1956. $0.50.

1110

PHOTOGEOLOGIC MAP OF THE TANNER WASH NW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-193. J. P. Minard. Washington, U. S. Geological Survey, 1956. $0.50.

1111

PHOTOGEOLOGIC MAP OF THE JACOB LAKE NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGICAL INVESTIGATIONS MAP I-194. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

1112

PHOTOGEOLOGIC MAP OF THE WHITE CANYON-3 QUADRANGLE, SAN JUAN AND GARFIELD COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-195. P. P. Orkild. Washington, U. S. Geological Survey, 1956. $0.50.

1113

PHOTOGEOLOGIC MAP OF THE HOUSE ROCK SPRING NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-198. J. P. Minard. Washington, U. S. Geological Survey, 1956. $0.50.

1114

PHOTOGEOLOGIC MAP OF THE HOUSE ROCK SPRING SE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-199. Kathleen McQueen. Washington, U. S. Geological Survey, 1956. $0.50.

1115

PHOTOGEOLOGIC MAP OF THE TIDWELL-11 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-227. A. B. Olson. Washington, U. S. Geological Survey, 1956. $0.50.

1116

PHOTOGEOLOGIC MAP OF THE PARIA PLATEAU NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-228. Kathleen McQueen. Washington, U. S. Geological Survey, 1956. $0.50.

1117

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN-1 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-229. A. B. Olson. Washington, U. S. Geological Survey, 1956. $0.50.

1118

WALL-ROCK CONTROL OF CERTAIN PITCHBLENDE DEPOSITS IN GOLDEN GATE CANYON, JEFFERSON COUNTY, COLORADO. John W. Adams and Frederick Stugard, Jr. U. S. Geol. Survey Bull. 1030-G, 1956. 25p., 1 illus. $0.50 (GPO)

Carbonate veins cutting metamorphic rocks of Precambrian age in the Golden Gate Canyon area, Colorado, contain pitchblende and base-metal minerals. The veins occupy ex-

tensive faults considered to be of Laramide (earliest Tertiary) age, but normally contain pitchblende only where they cut hornblende gneiss. At the Union Pacific deposit, which was studied in detail, pitchblende, hematite, and some ankerite formed before the sulfide minerals, except possibly for minor earlier pyrite. Base-metal minerals and the bulk of the ankerite vein filling were deposited after the pitchblende. Chemical analyses show a high ferrous iron content in the hornblende gneiss in contrast to low ferrous iron in the adjacent biotite gneiss. It is thought that ferrous iron released by alteration of hornblende was partly oxidized to hematite by the ore-bearing solutions and, contemporaneously, uranium was reduced and deposited as pitchblende. In other veins that are not in hornblende gneiss, biotite or iron sulfide may have been similarly effective in precipitating pitchblende. Apparently both the ferrous ion and the sulfide ion can serve as reducing agents and control pitchblende deposition. Conditions that seem favorable for uranium deposition include those where uranium-bearing solutions had access to rocks rich in ferrous iron or preexisting sulfide minerals. (auth)

METALS AND METALLURGY

1119 AD-89650

Schwarzkopf Development Corp., Yonkers, N. Y.

EVALUATION OF NEW HIGH TEMPERATURE MATERIALS. Progress Report No. 2 [for] December 1, 1955–February 29, 1956. Robert D. Grinthal. 28p. Contract AF33(616)-3198.

Results indicate that copper additions to molybdenum disilicide tend to decrease room temperature strength, increase electrical resistivity and lower oxidation resistance at elevated temperatures. Several compositions in the chromium–molybdenum–silicon ternary system have been arc melted and identified by x-ray-diffraction methods. Powder is presently being reacted which corresponds with the arc melted compositions, and which will be fabricated into test samples by powder metallurgical methods. (auth)

1120 AD-94649

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

RELATIVE HIGH TEMPERATURE PROPERTIES OF THE HEXAGONAL-CLOSE-PACKED AND BODY-CENTERED-CUBIC STRUCTURES IN IODIDE–TITANIUM. Interim Technical Report. John Lunsford and Nicholas J. Grant. Feb. 1956. 20p. Contract NOas-56-110-D.

Stress-to-rupture properties of iodide–Ti were investigated in air from 1000 to 1990°F around the alpha-to-beta transformation temperature of 1620°F. Strain nucleation participates in the early recrystallization of the hexagonal-close-packed phase, and oxygen alloying from the atmosphere contributes significantly to the over-all strength of both phases. The hexagonal-close-packed α phase exhibits the greater strength of the two, thus suggesting itself as the better high temperature matrix. (auth)

1121 AECU-3154

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

RESEARCH ON URANIUM-BASE ALLOYS. PART I. TRANSFORMATION KINETICS OF URANIUM-BASE ALLOYS. Final Report, November 15, 1952–August 31, 1955. R. J. Van Thyne and D. J. McPherson. Sept. 30, 1955. 106p. Project B 049, for Westinghouse Electric Corp. Atomic Power Div. Subcontract 73-(14-309), Task 6. $16.80(ph OTS); $5.70(mf OTS).

Information concerning the transformation kinetics of the gamma solid solution of U-base alloys is important. Accordingly, the metastability of the gamma phase was investigated for nine U-rich alloys of the U–Mo, U–Mo–Pt, U–Mo–Nb and U–Nb systems. Samples were encapsulated in Vycor bulbs, solution treated at 1000 or 1050°C, quenched to and annealed at temperatures between 600 and 300°C. Techniques employed to follow transformation included metallography, resistivity, x-ray-diffraction and hardness. A difference exists between the TTT curves for the same alloy determined by different techniques. However, this is readily explained. The body-centered cubic gamma phase of the U–Mo and U–Mo–X alloys decomposes eutectoidally to form alpha and epsilon, an ordered structure. The eutectoid temperature is about 575°C in the binary system. In the U–Nb system the gamma solid solution decomposes monotectoidally (or eutectoidally) to a product of alpha and another Nb-rich gamma phase. Alpha U has characteristic low solubility for either of the alloy components. The nose of the TTT curves for the U–5.4 wt. % Mo and U–10 wt. % Nb compositions exists at about 550°C and 0.1 hour. Minimum times for transformation are longer for the other alloys. Rather long times were generally required for transformation to occur at temperatures below 400°C. For this reason, annealing times up to 2000 hours were employed. For all the annealing treatments used, decomposition of the gamma solid solution was complete only for a few compositions at 500°C. (auth)

1122 AECU-3183

Minnesota. Univ., Minneapolis. Inst. of Tech.

THE EFFECT OF CHEMICAL NATURE OF HEATING SURFACES ON THE HEAT TRANSFER COEFFICIENTS OF POOL BOILING LIQUIDS. Final Report for February 1, 1952–June 15, 1955. George W. Preckshot. Dec. 30, 1955. 61p. Contract AT(11-1)-219. $0.40(OTS).

An investigation was made of the effect of the chemical nature of the heat transfer surfaces on the boiling heat transfer coefficients when the boiling takes place from a pool. Apparatus and procedures were developed for an understanding of the boiling process. Metallic surfaces of Au and Ag were uniformly placed on Cu wires by vapor coating. Coating thickness was determined by chemical methods. An apparatus for the determination of surface energies using gravimetric vapor adsorption isotherm measurements was assembled. Finely divided metallic powders of two surfaces (Cu, Ag) to be used for the boiling studies were prepared for the surface energy measurements. (F.S.)

1123 ANL-5548

Argonne National Lab., Lemont, Ill.

SPECIAL HEAT OF AUSTENITIC STAINLESS STEEL USED IN THE EXPERIMENTAL BREEDER REACTOR (EBR-1). Work Completed: September 1949. Robert A. Noland and David E. Walker. Oct. 1956. 16p. Contract W-31-109-eng-38. $0.20(OTS).

The heat of austenitic stainless steel which was used in the core structure of the Experimental Breeder Reactor is described. The heat was made by the Crucible Steel Company of America at their Midland, Pennsylvania, mill to conform with a modification of the ASTM specification A-269-47, a Nb-stabilized, austenitic grade stainless steel similar to AISI Type 347. Modification consisted of selecting a narrow range of composition within the broad range ordinarily permitted for most of the elements specified. This was done to promote austenite stability and freedom from carbide precipitation, without altering the fabricability of the material. Components manufactured from this heat were intended to operate in sections of varying neutron flux density and temperature. They were to be ex-

posed to NaK alloy and/or air under static and dynamic conditions at peak temperatures in the range 325°–350°C. The steel was mill fabricated into a number of products, including rounds, rods, light and heavy plate, seamless tubing, and foil (0.020"). No difficulty was encountered in machining, grinding, deep drawing, forging, cold drawing, swaging, or welding this material. (auth)

1124 BMI-1123

Battelle Memorial Inst., Columbus, Ohio.

PROPERTIES OF A FISSIUM-TYPE ALLOY. Henry A. Saller, Ronald F. Dickerson, Arthur A. Bauer, and Norman E. Daniel. Aug. 3, 1956. Decl. Nov. 2, 1956. 32p. Contract W-7405-eng-92. $0.35(OTS).

The interest in recycled fuels for use in power reactors has led to a study of a fissium-type alloy, which may be defined as an artificial alloy representing fuel containing an equilibrium amount of fission products produced after an infinite number of irradiation and metallurgical reprocessing cycles. The nominal composition of the alloy was as follows: 2.5 wt. % Mo, 1.5 wt. % Ru, 0.5 wt. % Pd, 0.3 wt. % Rh, 0.1 wt. % Zr, and the balance normal U. It was found that the alloy behaved similarly to the binary U–5.0 wt. % Mo alloy during heat treatment and fabrication. The alloy ages relatively fast in the temperature range between 450 and 600°C, but it is relatively soft when quenched from 800°C or above. Indications are that the alloy is less stable during thermal cycling than binary U–Mo alloys, and that the tensile properties of the alloy will compare favorably with the U–5 wt. % Mo alloy. However, before any conclusions can be drawn in regard to the possible use of such an alloy in reactor fuel elements, a more exhaustive study of the alloy should be made. (auth)

1125 HW-44905

Hanford Atomic Products Operation, Richland, Wash.

ON THE ANNEALING AND AGING OF ZIRCALOY-3b. Dale E. Johnson. Aug. 22, 1956. 35p. Contract [W-31 109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

A study was made to determine the effect of both short time and long time annealing on the tensile test properties of Zircaloy-3b. The effect of alpha phase annealing on the microstructure and mechanical properties of a simulated Zircaloy-3b weld structure was also investigated. A preliminary study of the aging of Zircaloy-3b was conducted. As a result of this study, the following conclusions were reached: the short time annealing of cold-worked Zircaloy-3b at a temperature of 725 to 750°C produces a material ductility that is essentially equivalent to the ductility obtained with long time inert atmosphere annealing treatments, the alpha phase annealing of Zircaloy-3b weld structures should probably be avoided unless the weld is first cold worked, and the strain-aging effects were observed with Zircaloy 3b. (auth)

1126 HW-44989

Hanford Atomic Products Operation, Richland, Wash.

AN EVALUATION OF THE ZIRCONIUM HAZARD. W. R. DeHollander. Aug. 15, 1956. 22p. Contract W-31-109-Eng-52. $0.20(OTS).

A literature search was made in order to determine the factors involved in Zr fires and explosions. Recommendations are made as to the handling, storage, and disposal of various forms of Zr. (T.R.H.)

1127 LM/TAB-2

Mine Safety Appliances Co., Pittsburgh.

LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR THE PERIOD SEPTEMBER 1 TO OCTOBER 31, 1956. Nov. 1, 1956. 28p.

1128 NAA-SR-1688

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ZONE MELTING BY ELECTRIC ARC. R. D. Burch. Nov. 15, 1956. 16p. Contract AT-11-1-GEN-8. $0.20 (OTS).

An apparatus is described which uses a d-c arc to produce a molten region for a zone-melting purification process. A specimen metal bar rests on a water-cooled hearth and serves as an anode. Metal in the liquid zone retains its continuity by virtue of surface tension and cohesion forces existing between it and the solidified pieces on each side. This adaptation of the arc furnace principle has the salient feature of low contamination. The data obtained indicate preferential migration of Zr in Th–Zr alloys, with the best results indicating an end-to-end redistribution factor of about three after three passes. This investigation was carried out to determine prospects of fission-product removal from Th-rich fuel materials. (auth)

1129 NAA-SR-Memo-758

North American Aviation, Inc., [Downey, Calif.]

PROPOSED PROGRAM TO PROVIDE DESIGN DATA FOR ZIRCONIUM FOR USE IN A ZIRCONIUM–GRAPHITE–SODIUM REACTOR SYSTEM. F. E. Bowman. Aug. 7, 1953. Decl. June 6, 1956. 13p. $3.30(ph OTS); $2.40 (mf OTS).

A brief résumé of the strength and sodium corrosion data that have been found available in the classified literature is given. Tensile properties of Zr and Zr alloys at 500°F, comparison of room temperature and 500°F tensile and creep properties of various Sn–Zr alloys, stress rupture of Zr–Al alloys in Na at 1000°F and a proposed research program are included. (F.S.)

1130 NYO-7056

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

X-RAY DETERMINATIONS OF ORDER AND ATOMIC SIZES IN Co–Pt SOLID SOLUTIONS. Technical Report No. 34. P. S. Rudman and B. L. Averbach. July 31, 1956. 37p. Contract AT(30-1)-1002. $6.30(ph OTS); $3.00(mf OTS).

The equilibrium long-range order in the alloy CoPt has been determined by means of x-ray intensity and lattice tetragonality measurements on powder briquettes quenched from various annealing temperatures. The critical temperature, T_c, is 833 ± 2°C, and the long-range order vanishes discontinuously on heating, at a value of S_c = 0.78. Local order and size-effect coefficients were also obtained for a series of disordered Co–Pt alloys by means of diffuse x-ray scattering measurements from quenched powder briquettes. A preference for unlike nearest neighbors was found with magnitudes comparable to those observed in the Au–Cu system. (auth)

1131 OSR-TR-56-54

Horizons, Inc., Cleveland.

INVESTIGATION OF A NEW METHOD FOR THE DETERMINATION OF THE COEFFICIENTS OF SURFACE DIFFUSION OF METALS. Final Progress Report. Peter F. Mataich. Sept. 10, 1956. 67p. Project No. R-355-30-2. Contract AF18(600)-644. (AD-110344).

Results of experiments to develop new methods for determining the surface diffusion coefficients of metals are reported. Interferometric, steady state, and autoradiographic methods are described for measuring diffusion coefficients. The theoretical background and experimental techniques for each of the three methods are in-

cluded. Data are given for a Ag–Au system. (For preceding report see NP-5874.) (J.H.M.)

1132 SO-2526

General Electric Co. Research Lab., Schenectady, N. Y.
DEVELOPMENT OF ZIRCONIUM-BASE ALLOYS. Final Summary Report. J. H. Keeler. Nov. 1956. Contract W-31-109-Eng-52. (56-RL-1648). $4.80(ph OTS); $2.70(mf OTS).

A summary of earlier reports on the alloying characteristics of Zr-base alloys is presented. (J.E.D.)

1133 TID-3310

Technical Information Service Extension, AEC.
PRODUCTION OF THORIUM METAL: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Oct. 1956. 12p. $0.15(OTS).

This bibliography contains 35 references to unclassified reports on the production of Th metal. A report number index is provided. (auth)

1134 TML-36

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
FIRST ANNUAL REPORT, 1955–1956. Feb. 27, 1956. 129p. Contract AF18(600)-1375. (AD-88438).

A survey of the Ti industry in 1955 prefaces this nontechnical description of the Titanium Metallurgical Lab., its activities, operation, tasks, and future plans. Included is a summary of reports issued, technical inquiries answered, visits made, visitors received, and technical assistance rendered. (T.R.H.)

1135 TML-56

Battelle Memorial Inst., Columbus, Ohio.
THE ELASTIC CONSTANTS IN STRUCTURAL DESIGN WITH PARTICULAR APPLICATION TO TITANIUM. S. A. Gordon. Oct. 19, 1956. 33p. Contract AF18(600)-1375.

The elastic constants of materials and their application to design formulas are discussed. Studies are presented to show the effect of variations in these constants on the formulas in which they are used. Typical design curves are presented for Ti and 17-7PH for columns, buckling, and crippling of open sections, and torsion in cylinders. An analysis is also presented of several typical beams and columns to show the effect of the modulus of elasticity of Ti and 17-7PH on the over-all deflection of structures. The basic developments are reported so that additional design curves can be plotted for different elastic constants or materials of different strengths. (auth)

1136 WADC-TR-53-24(Pt. 1)

Cornell Aeronautical Lab., Inc., Buffalo.
INTERMITTENT STRESSING AND HEATING TESTS OF AIRCRAFT STRUCTURAL METALS. Period Covered: April 5, 1950 to August 31, 1952. G. J. Guarnieri. May 1954. 78p. Contract AF33(038)-10958. (AD-40138).

Methods for testing and data evaluation capable of defining the creep-rupture properties of aircraft alloys subjected to intermittent heating and loading were developed. Creep-rupture test equipment was developed and constructed capable of testing sheet specimens under various conditions of constant or intermittent temperature and load. 24S-T3 Alclad Al has been studied in the 300 to 600°F temperature range at stresses capable of producing various amounts of deformation and rupture in time periods extending from several hours to at least several hundred hours. In addition to establishment of the reference constant temperature-constant load creep-rupture data, comparable results were obtained under conditions of constant temperature-cyclic load, constant load-cyclic temperature, and combined cyclic load-cyclic temperature. A similar program has been in progress for FS-1H Mg with data having been procured to date for the constant temperature-constant load and the constant temperature-cyclic load conditions. Correlation of the intermittent heat and load data with the more conventional constant temperature and load properties has been made to advantage on both a time and stress basis. Only over a limited range of conditions for a particular alloy were creep deformations and rates found to be proportional to the time of application of the interrupted load or heat variable. The complicating factors of recovery in both the 24S-T3 and FS-1H and overaging in the 24S-T3 introduced accelerating creep effects which resulted in cyclic vs. static deformation and rupture time ratios less than would be predicted from the loading and heating time schedules. (auth)

1137 WADC-TR-54-485(Pt. III)

National Bureau of Standards, Washington, D. C.
ELECTRODEPOSITION OF TITANIUM. [Period covered]. January 1955 to March 1956. Walter E. Reid, Jr., Jean H. Connor, and Abner Brenner. Sept. 1956. 17p. Project Title: FINISHES AND MATERIALS PRESERVATION; Task Title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF(33-616)-53-11. (NBS-4806; AD-110402).

The study of Ti–Al alloy baths was extended. The possibility of using Na or K borohydride instead of Li borohydride to prepare the Ti and Zr borohydrides was examined. Among the new compounds prepared for use in the Ti–Al alloy bath were chloroborohydride etherates of Ti. Some work was done on the use of organometallic Al compounds in a Ti alloy bath rather than the hydride Al bath previously used. Alloys of Ti or Zr with Mg were obtained from a hydride type of bath. Codeposition of some metals similar to Ti, namely Hf and Th, with Al from the borohydride bath was studied for purposes of comparison with the Ti–Al alloys. A number of reactions between reactive organic compounds and Ti salts were performed in the search for a suitable Ti plating bath. This included an unsuccessful attempt to prepare ethyltitanium and a tetraphenyl borate derivative of Ti. (auth)

1138 WADC-TR-55-325(Pt. II)

Syracuse Univ., N. Y.
THE EFFECTS OF INTERSTITIAL CONTAMINANTS ON THE NOTCH-TENSILE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. PART II. ALLOY TITANIUM [Period covered] November 15, 1953 to October 1, 1955. E. P. Klier and N. J. Feola. Aug. 1956. 200p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2281. (AD-97199).

The notch-tensile properties of alloy Ti contaminated with O, N and C have been determined. In all, six alloys have been studied, and the effects of the various contaminants on the notch sensitivity have been presented in discussion of the results for each alloy. Notch sensitivity has been shown to depend on the tensile strength, and becomes potentially severe as the strength exceeds about 150,000 psi. Metallographic structure and alloy content also profoundly affect notch sensitivity in these alloys. The effects of testing temperature, contamination level, and strain rate on promoting notch sensitivity in the respective alloys are also discussed. (auth)

1139 WADC-TR-56-327

Allegheny Ludlum Steel Corp. [Research Dept., Watervliet, N. Y.]
INVESTIGATION OF FORGED COBALT BASE ALLOYS FOR HIGH TEMPERATURE APPLICATIONS. [Period covered] February 1, 1955 to May 31, 1956. R. R.

MacFarlane, R. K. Pitler, and E. E. Reynolds. Aug. 1, 1956. 35p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-2882. (AD-110409).

Developmental studies were made of a wrought Co-base alloy for applications at high temperatures. Additions of Al improved oxidation resistance and lowered rupture strength. B additions up to 0.2% increased rupture strength and ductility. This increase was limited by a necessarily low solution temperature of 2150°F since, at 2200°F, eutectic melting of a B phase occurred. Ti additions resulted in a large increase in room temperature hardness through an aging reaction but yielded no improvement otherwise. Attempts at improving the workability of unforgeable air melted modifications by vacuum consumable electrode and vacuum induction melting techniques were not successful. (auth)

1140 WADC-TR-56-421

Kentucky. Univ., Lexington.

PREFERRED ORIENTATIONS AND KINETICS OF RECRYSTALLIZATION IN TITANIUM. Final Report Summarizing the Work from August 1954 to July 1956. Cullie J. Sparks, Jr. and Joseph P. Hammond. July 1956. 72p. Project title: METALLIC MATERIALS. Task title: THE EFFECT OF COMPOSITION AND INTERNAL STRUCTURE ON THE PROPERTIES OF ALLOYS. Contract AF 33(038)-19574. (AD-110470).

Preferred orientations were produced in Ti by cold rolling and cross rolling and in a Ti–Al alloy by cold rolling. The reorientations occurring during annealing were studied quantitatively using an x-ray diffractometer. The kinetics of recovery and recrystallization were studied for isothermally annealed 94% cold-rolled Ti. This included grain growth, hardness, line breadth recovery and measurements of reorientation on annealing. Activation energies for the several processes were calculated and compared. Titanium was found to behave somewhat different than other metals to annealing. The process of recovery and recrystallization occurs almost simultaneously in cold-rolled Ti. Variation of yield strength with direction in the rolled sheet for commercial Ti and a Ti–Al alloy were found to be qualitatively predictable by applying the law of critical resolved shear stress to the pole figures of annealed sheet. Because of mechanical fibering, the yield strength of the cold-rolled sheet did not follow the predictions. (auth)

1141 WAPD-155

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

DEVELOPMENT OF U_3Si EPSILON PHASE ALLOYS FOR USE IN PRESSURIZED WATER REACTORS. R. A. Wolfe, W. E. Bond, W. A. Bostrom, I. Cohen, and R. B. Roof, Jr. July 15, 1956. 73p. Contract AT-11-1-GEN-14. $0.45 (OTS).

The results of the investigation indicate that increasing amounts of carbon lower the equilibrium temperature of the peritectoid reaction for the conversion of gamma plus delta to the epsilon phase. The epsilonizing reaction becomes more sluggish at lower peritectoid temperatures and it is therefore necessary to limit the carbon content in order to obtain a uniform, epsilonized structure. The use of BeO-washed, graphite crucibles was found satisfactory to keep the carbon below 300 ppm when extra precautions were taken in applying the wash. Unclad cast alloys of U_3Si were found to have inherently better corrosion resistance than extruded alloys, mainly because of the absence of alpha uranium stringers. The average corrosion rates of cast materials when tested in 650°F water generally fall within the range of -1.0 to -2.0 mg/cm^2-hr. The presence of small amounts of Ta appears to have increased the corrosion resistance of these alloys. Corrosion-produced H has very little effect upon the corrosion reaction. Only about 1 to 3% of the nascent H is absorbed by the specimen during corrosion in 650°F water as compared to 20 to 25% absorbed by gamma U-12 wt. % Mo alloys corroded under the same conditions. The direct contact of U_3Si with zirconium and other silicide forming elements at high temperatures, such as are encountered in extrusion, will result in the formation of an alpha-U layer at the diffusion interface. Defected clad specimens in this condition will fail rapidly by bondline corrosion attack in elevated temperature water. Thus, a nonsilicide forming element in contact with the U_3Si is required to provide corrosion resistant fuel elements. Corrosion resistant, Al-base alloys appear to be promising for barriers between the U_3Si fuel and Zircaloy cladding. However, fabrication of sound elements of this type is hindered by the rapid reaction of U_3Si and Al to form the very brittle UAl_3 with weak interface bonds at the U_3Si/UAl_3 interface. (auth)

1142 AEC-tr-2669

THE INFLUENCE OF THE ELEMENTS ON THE POLYMORPHISM OF IRON. Willy Oelsen and Franz Wever. Translated by R. Todd from Arch. Eisenhüttenw. 19, 97-104(1948). 18p.

The application of thermodynamic relationships to the transition equilibria of iron-rich alloys is studied. Discussions are included of the heats of transformation of Fe, and the heat of transfer of an alloying element from the α- to the γ phase as characteristics of the type and position of the equilibrium curves for transitions in iron-rich alloys. (J.H.M.)

1143 AEC-tr-2693

METHODS OF INTRODUCING RADIOACTIVE PHOSPHORUS INTO METAL AND SLAG. V. N. Shikhov. Translated by R. C. Murray from Zavodskaya Lab. 21, 1482-3 (1955). 2p.

1144 AERE-Lib/Trans-672

THEORY OF PLASTIC DEFORMATION OF METALS. N. S. Akulov and P. P. Galenko. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 103, 387-90 (1955). 6p.

1145 AERE-Lib/Trans-763

THE THEORY OF THE METHOD OF DETERMINING THE GRAIN-BOUNDARY DIFFUSION COEFFICIENT FOR METALS. V. T. (G.) Borisov and B. Ya. Lyubov. Translated by J. Adam from Fiz. Metal. i Metalloved. 1, 298-302 (1955). 8p.

1146 IGRL-T/C-26

ON A NEW PHASE IN THE SYSTEM ALUMINIUM–SILICON–LITHIUM. E. A. Boom. Translated by E. Bevitt from Doklady Akad. Nauk S.S.S.R. 66, 645-6(1949). 2p.

1147 IGRL-T/C-27

ELECTRONMICROSCOPE INVESTIGATION OF THE CHANGES OF STRUCTURE OF A CHROMIUM–NICKEL–MOLYBDENUM–STEEL UNDER PROLONGED TENSILE STRESS AT 500°. F. Wever and A. Schrader. Translated by J. Standring from Arch. Eisenhüttenw. 26, 475-81 (1955). 9p.

Structure investigations were carried out using both the light and electron microscopes on steel containing 0.14% C, 0.77% Cr, 0.94% Mo and 1.6% Ni air-cooled and tempered at low temperature and oil quenched and tempered at low and high temperature followed by prolonged heating at 500° with and without stress. A technique for isolation of carbide by means of a stripped lacquer film is given. (auth)

1148 TT-640

REACTION KINETICS OF MAGNESIUM. (SUBOXIDE OF

MAGNESIUM. (Z Reakcní Kinetiky Magnesia. (K Otázce Suboxydu Hořčíbu)). A. Vyskocil. Translated from Chem. Listy 38, 17-21 and 27-33(1944). 32p.

Kinetic measurements have shown that when Mg is dissolved and corroded it can be differentiated between two distinct effects, namely the effect of the H ions and the anionic effect. It appears most probable that in both instances there is an adsorption phenomenon. This forms adsorbates of varying degrees of stability on the surface of the Mg. This is also one of the conditions determining the speed of the corrosion process. The highly adsorptive anions of certain acids (salts), which already cause passivity in certain metals having a lower potential (such as Fe), further tend to activate Mg. When Mg is dissolved in an acid environment there is an exhaustion of H ions. Where the dissolving of Mg takes place in solutions which are already almost neutral, or mildly basic, the anionic effect applies. This is the case in the dissolution of Mg in ammonium salt solution, carbonic acid and acidic carbonates. Carbonic acid in the course of the dissolution and the corrosion of Mg acts as if it were a very strong acid. In the salt solutions local anodes appear where the anions were able to take hold through adsorption (i.e., on the discontinuities of the metal). Thus this initial phenomenon causes the formation of local cells on the surface of the metal. On this basis it has been possible to explain the phenomenon of the continuing decomposition of water by means of Mg (at normal temperatures) in the presence of salts (such as alkaline metals and alkaline earths, for example), even after the solution had been previously made alkaline. Where the dissolution and corrosion of Mg in alkaline solution takes place at a sufficiently high rate, a black substance, also called magnesium suboxide, tends to appear. Thus it was once again demonstrated that Mg with its noteworthy characteristics can serve as a kind of pattern in the study of the corrosive processes in other materials and particularly in Fe. (auth)

1149

PRECIPITATE KINETICS AND STRUCTURE IN A Cu–2.4% Fe ALLOY. J. M. Denney (North American Aviation, Downey, Calif. and General Electric Research Lab., Schenectady, N. Y.). Acta Met. 4, 586-92(1956) Nov.

The kinetics of the isothermal precipitation of Fe from a supersaturated solid solution of Cu–2.4% Fe magnetization of the specimens. The rate limiting process in the development of the coherent Fe precipitate is the diffusion of Fe in the Cu matrix, described in part by an activation energy of 1.65 ± 0.1 ev. X-ray diffraction studies indicate the precipitate forms coherently with the Cu matrix. The coherent f.c.c. Fe precipitate transforms during plastic deformation to a stable ferromagnetic body-centered structure (perhaps b.c.t. with c/a = 1.1). Transformation of the coherent precipitate to the ferromagnetic structure is never observed by thermal treatment alone in the range 4 to 1073°K; but the precipitate transformation is readily accomplished by plastic deformation. (auth)

1150

AN X-RAY INVESTIGATION OF THE STRUCTURE OF LIQUID MERCURY AND LIQUID MERCURY-THALLIUM ALLOYS. R. E. Smallman and B. R. T. Frost (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Met. 4, 611-18(1956) Nov.

Intensity and atomic-distribution curves have been determined for pure mercury and four liquid Hg–Tl alloys at a constant temperature of 17°C ± 1°. The intensity curves, obtained using a Geiger-counter diffractometer, display highest and sharpest peaks on the first interference maxima for the alloys corresponding to the compound composition together with a significant alteration in interatomic distances. Fourier inversion of the intensity data to give atomic and electronic distribution functions was performed. The values of co-ordination number and closest distance of approach for the five liquids are in agreement with the indications of the intensity curves alone. In general, the diffraction data imply that there is a more orderly atomic arrangement in the liquid at a compound composition than at other compositions. (auth)

1151

METHOD OF REDUCING OXIDES OF TITANIUM AND ZIRCONIUM AND MAKING TITANIUM AND ZIRCONIUM ALLOYS. To: Metro-Cutanit Ltd. (Austria). British Patent 754,981. Nuclear Eng. 1, 316(1956) Oct.

Oxides of Ti and Zr are reduced with C and Si with carbide or silicide material under a high vacuum at 3000°C or above. One or more metals such as Mo, W, Cr, Al, Mn, and Ni facilitate alloying. An electric arc furnace may be used with the reacting metals forming the electrodes. (F.S.)

1152

STRUCTURAL PROPERTIES OF Ni–Al ALLOYS IN THE DECOMPOSITION PROCESS OF SATURATED SOLID SOLUTION OF ALUMINUM IN NICKEL. Yu. A. Bagaryatskiĭ and Yu. D. Tyapkin (Central Research Inst. of Ferrous Metallurgy). Doklady Akad. Nauk S.S.S.R. 108, 451-4(1956) May 21. (In Russian)

During the annealing process of Ni–Al alloys with 17 at. % Al(8.5 wt. %) at a certain decomposition step, of the hard solid solution, in addition to the basic reflections, an additional monocrystalline oscillating reflection appeared on the radiogram. Subsequent analysis and exposure revealed that the distances measured between the basic and satellite reflections in transition from one radiation to another is related to the appearance of a (001 type) lattice modulating parameter in the hard solution crystal similar to the one found in the magnetic alloys Cu–Ni–Fe and Ca–Ni–Co. For the conditions investigated the small distances between the basic and satellite reflections made the observations possible only at large x-ray reflection angles. (R.V.J.)

1153

EFFECTS OF THE INTERNAL STRUCTURE OF AUSTENITE GRAIN ON THE STRENGTH OF THE SOLID SOLUTIONS AT ELEVATED TEMPERATURE. G. V. Kurdyumov, E. Z. Kaminskiĭ and V. M. Rozenberg. (Central Research Inst. of Ferrous Metallurgy.). Doklady Akad. Nauk S.S.S.R. 109, 85-7(1956) July 1. (In Russian)

The grain structure of solid solutions with iron base containing 29% Ni (by weight) and 1% Ti was studied. The direct martensite transition took place at room temperature and was reversible at 640°. After smelting and forging, the samples were annealed at 1000 and 1100°. The effects of annealing time and stress treatments on the wear resistance of the solids were tested at 700° and x-ray recrystallization and diffusion patterns at elevated temperatures were analyzed. (R.V.J.)

1154

WHAT TECHNIQUES GRIND ZIRCONIUM BEST? J. J. Saber (Carborundum Co., Niagara Falls, N. Y.). Iron Age 178, No. 21, 100-1(1956) Nov. 22.

Extensive grinding tests were conducted on both the reactor type of Zr and a Sn–Zr alloy. The major classes of grinding investigated included surface, centerless, internal, cut-off, and snagging. Results indicated both materials can be ground successfully and in a similar manner at conventional speeds. Silicon carbide wheels work best although combination silicon carbide–aluminum oxide can be used. (auth)

1155

DETERMINATION OF THE CHARACTERISTIC TEMPERA-

TURE AND LATTICE DEFORMATIONS IN HIGH MELTING METALS AND ALLOYS. S. M. Nikolaeva and Ya. S. Umanskiĭ. (Stalin Moscow Inst. of Steel). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 631-5(1956) June. (In Russian)

The relation between the interatomic bond and characteristic temperatures for NiAl(CoAl, NiAl) and TiC and their solid solutions have been evaluated to determine the factors affecting their resistance to deformation at high temperatures. The magnitude of statistical and dynamic deformations in the crystalline lattices of the solid solutions formed by the replacement of Co(Ni) in diffusion into CoAl(NiAl), in fusion of Al in CoAl and NiAl, and for the cases of C deficit in Ti carbides were investigated and compared. (R.V.J.)

1156

RECRYSTALLIZATION PROPERTIES OF CERTAIN TWO-PHASED AGING ALLOYS. S. S. Gorelik (Stalin Moscow Inst. of Steel). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 653-8(1956) June. (In Russian)

Effects of temperature on the recrystallization and aging properties of Cu–Be and Inconels have been evaluated. Phase transformations were analyzed and constitution diagrams presented. (R.V.J.)

1157

SECONDARY HARDENING OF STEEL ALLOYED WITH VANADIUM, MOLYBDENUM, AND TITANIUM. L. V. Zaslavskaya, S. T. Kishkiv, N. F. Lashko, A. F. Platonova, N. M. Popova, and M. F. Rybina. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 684-8(1956) June. (In Russian)

1158

A STUDY OF THE CALCIUM REDUCTION OF BERYLLIUM OXIDE. J. H. Buddery and R. W. Thackray (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 3, 190-3(1956) Oct.

The Ca reduction of BeO has been studied in some detail. It has been shown that the reaction takes place when the Ca melts, and yields a mixture of CaO and of the compound $CaBE_{13}$. Provided that Ca is present in considerable excess the reduction goes substantially to completion. The compound $CaBe_{13}$ is readily separated from the lime and excess Ca by leaching in cold dilute CH_3COOH. Attempts to remove the Ca from the $CaBe_{13}$ by vacuum distillation and by reaction with H_2, Mg, Bi, or Pb were not successful. This behavior suggests that $CaBe_{13}$ is a moderately stable compound. (auth)

1159

TEMPERATURE DEPENDENCE OF RECOVERY PHENOMENA IN A COLD-ROLLED ALUMINUM SINGLE CRYSTAL. A. H. Lutts and Paul A. Beck (Illinois Univ., Urbana). J. Metals 8, 1226-8(1956) Oct.

The kinetics of isothermal x-ray line sharpening in heavily cold-rolled pure Al single appears to be relatively unchanged in the temperature range of annealing between 100 and 350°C. The kinetics of the early stages of isothermal softening of highly rolled pure Al crystals is also characterized by an initially higher and then gradual decreasing rate. The similarity in the kinetics and in the activation energy of the initial stages of softening and of x-ray line sharpening suggests the possibility that the rate of these two processes is determined by related elementary processes. (L.M.T.)

1160

EFFECT OF HYDROGEN ON ALPHA TITANIUM ALLOYS. G. A. Lenning, J. W. Spretnak, and R. I. Jaffee (Titanium Metals Corp., of America, Henderson, Nev., Ohio State Univ., Columbus, Ohio, and Battelle Memorial Inst., Columbus, Ohio. Nonferrous Phys. Metallurgy Div.). J. Metals 8, 1235-40(1956) Oct.

The effect of up to 200 ppm H_2 on the microstructure and mechanical properties of high-purity Ti containing O_2, N_2, Sn, and Al was investigated. Increasing the H_2 content resulted in precipitation of a hydride phase and decreased the notch-bend impact strength of the alloys containing O_2, N_2, and Sn, similar to the H_2 embrittlement of unalloyed high-purity Ti. No hydride precipitation or significant embrittlement of the Ti–5Al alloy was found with up to 180 ppm H_2. (auth)

1161

RECOVERY OF COLD WORKED HIGH PURITY Al–Mg ALLOYS. E. C. W. Perryman (Atomic Energy of Canada Ltd., Chalk River, Ont., Canada). J. Metals 8, 1247-52(1956) Oct.

The recovery of x-ray line broadening, hardness, and electrical resistivity from cold worked Al–Mg alloys has been investigated. The results, together with those from density measurements, suggest that Mg atoms freeze in the excess vacancies formed by cold working, and that this affects the climb of dislocations during the recovery process. (auth)

1162

RECRYSTALLIZATION AND GRAIN GROWTH IN IODIDE ZIRCONIUM. R. M. Treco (Bridgeport Brass Co., Bridgeport, Conn.). J. Metals 8, 1304-11(1956) Oct.

A systematic investigation has been made of the plastic deformation, recrystallization, and grain growth characteristics of swaged crystal bar Zr. It was observed that Zr can be cold worked and annealed for fabrication processes without difficulty, but that severe reductions produce a well defined fiber texture which is not removed by recrystallization. Deformation and growth processes affecting the microstructure are discussed in detail. The activation energy for recrystallization was found to vary with the degree of deformation, while a unique activation energy for grain growth was not obtained. Abnormal grain coarsening was observed after annealing severely worked material at 750°C. (auth)

1163

INTERMEDIATE PHASE IN THE URANIUM–ZIRCONIUM SYSTEM. A. N. Holden and W. E. Seymour (Vallecitos Atomic Lab., General Electric Co., San Jose, Calif. and Knolls Atomic Power Lab., Schenectady, N. Y.). J. Metals 8, 1312-16(1956) Oct.

The U–Zr system has been studied with particular regard to the existence, stability, and mechanism of formation of the intermediate δ phase. This phase has been identified as a stable phase existing in the region of 50% Zr, which forms by the ordering of the γ body-centered-cubic alloy on cooling. A phase diagram consistent with the information obtained in this study is presented. (auth)

1164

GAMMA LOOP STUDIES IN THE IRON-SILICON AND IRON-SILICON-TITANIUM SYSTEMS. Gordon G. Bentle and W. P. Fishel (North American Aviation Inc., Downey, Calif.). J. Metals 8, 1345-8(1956) Oct.

Dilatation studies were made on 18 binary and 38 ternary alloys to determine the Ac3 transformation temperature. Points taken from temperature vs. expansion curves were used to establish the limit of the γ Fe region in the Fe–Si–Ti systems. (auth)

1165

Ti–36 PCT Al AS A BASE FOR HIGH TEMPERATURE ALLOYS. Joseph B. McAndrew and H. D. Kessler (Armour Research Foundation, Chicago and Titanium Metals Corp. of America, Henderson, Nev.). J. Metals 8, 1348-53(1956) Oct.

An experimental survey was made of the oxidation resistance, stress rupture strength, creep, and impact

strength of Ti–36% Al at elevated temperature. Room temperature mechanical properties were measured. A few ternary alloys based on Ti–36% Al were also studied in less detail. Both desirable and undesirable properties were found. (auth)

1166

CONSTITUTION OF NICKEL-RICH QUATERNARY ALLOYS OF THE Ni–Cr–Ti–Al SYSTEM. A. Taylor (Research Labs., Westinghouse Electric Corp., Pittsburgh). J. Metals 8, 1356-62(1956) Oct.

The quaternary system Ni–Cr–Ti–Al has been studied up to a temperature of 1150°C for compositions greater than 50 atomic pct Ni. It has been shown that the region contains six single phase areas, namely, the face-centered-cubic nickel-rich primary solid solution γ, the face-centered-cubic ordered phase γ' based on Ni_3Al, the hexagonal-close-packed intermetallic compound η-Ni_3Ti, and the three body-centered-cubic phases β_1-NiAl, β_2-NiTi, and β_3-Ni_2TiAl. As the temperature is raised, the volume of the quaternary tetrahedron occupied by the γ phase increases quite considerably, while that of γ' decreases. The tie-lines across $\gamma + \gamma'$, $\gamma + \eta$, and $\gamma' + \eta$ two-phase fields lie almost exactly in the plane Ni_3Cr–Ni_3Al–Ni_3Ti, these three positions effectively outlining a pseudo-ternary system with the $\gamma + \gamma' + \eta$ triangle corresponding closely to a tie-plane. There is strong evidence that a four-phase field links the binary phases γ, γ', and η with the ternary phase β_3-Ni_2TiAl. (auth)

1167

VARIATIONS IN RADIATION DAMAGE TO METALS. C. A. Bruch, W. E. McHugh, and R. W. Hockenbury (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Metals 8, 1362-72 (1956) Oct.

A group of metals including Cu, Ni, Ti, Zr, Fe, Mo, and type 347 stainless steel were irradiated at approximately equal exposure conditions in the Materials Testing Reactor. Measurements were made of some mechanical and physical properties to determine the extent of radiation damage to each metal. Some aspects of the theory of radiation damage to metals by neutrons were considered, and calculations were made of the concentrations of several kinds of defects produced, neglecting annealing effects. The differences among the metals in the calculated concentrations of defects were small, and could not be correlated with the observed differences in radiation damage. On the basis of empirical considerations, two factors which appear to exert strong influences on the magnitude of the changes in properties due to irradiation are the crystal structure and the pre-irradiation value of the physical or mechanical property prior to irradiation. (auth)

1168

EFFECT OF Mo, W, AND V ON THE HIGH TEMPERATURE RUPTURE STRENGTH OF FERRITIC STEEL. A. E. Powers (Materials and Process Lab., Large Steam Turbine-Generator Dept., Schenectady, N. Y.). J. Metals 8, 1373-7 (1956) Oct.

A study was made of the effects of large amounts of Mo, W, and V and combinations of these alloying elements on the high-temperature rupture strength of a 0.18 pct C, 0.85 pct Mn, 0.48 pct Si steel which was oil quenched from at least 2100°F and tempered to a hardness of 250 Brinell. Both high and low testing temperatures were considered. The results were correlated with the effectiveness of the alloying elements in the form of carbides and in solid solution. The tempering behavior of the alloys was also studied. (auth)

1169

HEAT TREATMENT AND MECHANICAL PROPERTIES OF Ti–Mo ALLOYS. F. C. Holden, H. R. Ogden, and R. I. Jaffee (Non-Ferrous Physical Metallurgy Div., Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 1388-93(1956) Oct.

Mechanical properties of the Ti–Mo alloys are dominated by the quantity and composition of β phase present in the microstructure. Extensive α-β annealing treatments are required to reach equilibrium at lower annealing temperatures. Soft, ductile β phase can be formed on quenching, although high hardness values are obtained by aging at 400°C. The formation of strain-induced martensite in retained β over the composition range of 8 to 16 pct Mo results in low yield-to-ultimate strength ratios, high uniform elongation, and high resistance to impact. (auth)

1170

BETA-OMEGA AGE HARDENING MEANS STRONGER ZIRCONIUM ALLOYS. H. A. Robinson, J. R. Doig, M. W. Mote, C. M. Schwartz, and P. D. Frost (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 1544-5(1956) Nov.

The β-ω phase transformation, important in many titanium alloys, has been revealed in zirconium alloys. Hitherto unattainable tensile strength with adequate ductility is now feasible for certain zirconium alloys. It is expected that many new applications will result from this discovery. (auth)

1171

SELF-DIFFUSION OF IRON IN MOLTEN Fe–C ALLOYS. Ling Yang, M. T. Simnad, G. Derge (Carnegie Inst. of Tech., Pittsburgh). J. Metals 8, 1577-80(1956) Nov.

Self-diffusion coefficients of iron in molten Fe–C alloys have been measured by using the capillary method. In addition, the samples have been autoradiographed and sectioned to insure that no significant convection has occurred during the diffusion. The results can be represented by the equation $D = 4.3 \times 10^{-3} \exp(-12{,}200/RT)$ for C = 4.6% and T = 1513° to 1633°K; and $D = 1.0 \times 10^{-2} \exp(-15{,}700/RT)$ for C = 2.5% and T = 1613 to 1673°K. The D values are higher and the heat of activation for diffusion lower in alloys containing more C. Calculation based on the Einstein-Stokes equation indicates that the diffusing species is Fe ion. (auth)

1172

THE THERMAL EXPANSION OF PURE METALS AND THE POSSIBILITY OF NEGATIVE COEFFICIENTS OF VOLUME EXPANSION. J. H. O. Varley (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A237, 413-21(1956) Nov. 6.

The dominant factors controlling the volume thermal expansion of solids are discussed. It is shown that if the Fermi energy of the electron gas has a value for which the density of states of the electrons changes sufficiently rapidly with energy, a negative coefficient of volume expansion may reasonably be expected, particularly if this is associated with a high electronic specific heat from a large number of overlapping bands. It is suggested that this is the reason underlying the observed negative coefficient volume expansion of the cubic phase in Pu. (auth)

1173

ON HEATS OF FORMATION IN BINARY INORGANIC SYSTEMS. Uu. M. Golutvin (Baĭkov Inst. of Metallurgy). Zhur. Fiz. Khim. 30, 232-4(1956) Jan. (In Russian)

An attempt is made to establish the linear relations between the heats of formation of complexes in binary inorganic systems. (R.V.J.)

1174

ELECTRIC PROPERTIES OF InAs. D. N. Nasledov and A. Yu. Khalilov. Zhur. Tekh. Fiz. 26, 251-4(1956) Feb. (In Russian)

Studies were made of the InAs electroconductivity relation to the temperature, Hall's effect, and the resistance

changes in a magnetic field. An abnormally high electron mobility was observed at high temperatures. Tests were made in the temperature interval from 1.3 to 673°K, in magnetic field of up to 33,000 oersted. (R.V.J.)

Refer also to abstract 921.

PHYSICS

1175 AD-85559
New York Univ., New York. Coll. of Engineering.
RESEARCH ON PELTIER EFFECT COOLING. Final Report. E. Miller, I. Cadoff, and M. Telkes. Aug. 31, 1955. 63p. DA Project No. 3-99-13-022. Contract DA-36-039-sc-64422.

Positive thermoelectric materials of Zn–Sb and Zn–Bi base were prepared and the effect of addition of Bi, Sn, and Ag on resistivity and thermoelectric power determined. Data relating temperature drop and coefficient of performance with current and wattage input for Peltier effect thermocouples are given. Two soldering techniques for low contact resistance are described. (T.R.H.)

1176 AD-94417
Oklahoma Agricultural and Mechanical Coll., Stillwater.
THE CONSTRUCTION OF A FURNACE CALORIMETER AND THE EVALUATION OF A METHOD OF THERMAL ANALYSIS FOR OBTAINING THE SPECIFIC HEAT OF SOLIDS AT HIGH TEMPERATURES (thesis). Joseph Ambrose Rea. May 1956. 59p.

A method is described for obtaining the specific heat of solids at high temperatures. An electric furnace was designed, and specific heat tests were made on Tl. Experimental procedures and results are given, and a selected bibliography is included. (J.H.M.)

1177 HW-40947
Hanford Atomic Products Operation, Richland, Wash.
EFFECT OF NEUTRON INTERACTION ON CRITICALITY. G. W. Stuart, Jr. Jan. 16, 1956. Decl. Mar. 13, 1956. 22p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70 (mf OTS).

A general method is developed to allow calculation of the critical buckling of an assemblage of fissile regions coupled by neutron leakage. Consideration is given both to regions embedded in vacuum and in material media. Several cases of simple geometry are further developed to illustrate the theory. (auth)

1178 NP-6140
New York Univ., New York.
RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 5 [for] February, March, April 1956. Physics Dept. Hartmut Kallmann. Aug. 1956. 65p. Project No. 196B. Contract DA-36-039-sc-64526.

General considerations of energy transfer in liquid organic systems are reviewed, particularly those pertaining to energy transfer by radiation or by collisions. A comparison is made of energy transfer and quenching of solvents and solutes. Some of the features of energy transfer in solutions with more than one "solvent" are also discussed. In particular, data are given on the energy transfer via the intermediate "solvent", naphthalene. Data are included on quenching by carbon tetrachloride and chloroform and on the reduction of quenching due to naphthalene. Quenching by O_2 is also discussed. Further investigations on the a-c photoconductivity of phosphor L. G. are reported. The resulting data are summarized in graphical form. (For preceding period see NP-6032.) (B.J.H.)

1179 NP-6141
New York Univ., New York.
RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 6 [for] May, June, July 1956. Physics Dept. Hartmut Kallmann. Sept. 1956. 84p. Project No. 196B. Contract DA-36-039-sc-64526.

Results are presented on the quenching of the fluorescence of various organic molecules by CCl_4 under excitation by light and γ rays. The various molecules considered were 2,5-diphenyloxazole, 1,6-diphenyl-hexatriene, 1,4-diphenylbutadiene, p-terphenyl, phenylbiphenyloxadiazole, pyrene, 9,10-dichloroanthracene, fluoranthene, xylene, and durene. Work on the de-excitation of ZnCdS phosphors by electric fields is also discussed. Results of rise time measurements are summarized graphically. Measurements along the decay curve are described with and without fields. Measurement of a-c photoconductivity in phosphors were made at −65°C. (For preceding period see NP-6140.) (B.J.H.)

1180 NP-6145
Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.
SOME FRAMING CAMERA STUDIES OF PHENOMENA ASSOCIATED WITH THE DETONATION OF HIGH EXPLOSIVES. Technical Report NO. LI. R. T. Keyes. May 7, 1956. 45p. Project No. 357-239. Contract No. N7-onr-45107.

Selected examples from high speed framing camera photographs of detonation phenomena are presented together with descriptions and explanations of the processes occurring. These examples include blast contours for various explosives, (profiles of expanding detonation products around a detonating charge) cone collapse photographs, and photographs showing the collapse of other liners such as hemispheres and wedges. A description is given of a light source which was developed to permit high speed photography of non-luminous phenomena. (auth)

1181 NYO-7397
Columbia Univ., New York. School of Mines.
ULTRASONIC MEASUREMENTS ON LIQUID METALS. Period [covered] June 1955–February 1956. R. B. Gordon. Feb. 29, 1956. 9p. Contract AT(30-1)-1817. (CU-1-56-AEC-1817-Met.) $1.80(ph OTS); $1.80(mf OTS).

Apparatus used for velocity of sound measurements in liquid metals is described. The results of measurements on pure liquid Sn and Pb–Sn alloys are reported. (auth)

1182 UCRL-3513
California. Univ., Berkeley. Radiation Lab.
RANGE-ENERGY MEASUREMENTS IN EMULSION. Walter H. Barkas, Frances M. Smith, and Harry H. Heckman. Aug. 17, 1956. 7p. Contract W-7405-eng-48. $0.15(OTS).

Three new range points in the low-energy region have been determined for Ilford G.5 emulsion of known density. The particle energies were accurately known, and special precautions were taken to avoid certain types of errors known to have been associated with earlier measurements. The equivalent proton ranges in emulsion of density 3.815 g/cm^3 are: 1.295 Mev, 20.8 ± 0.2 microns; 2.420 Mev, 54.04 ± 0.55 microns; and 13.959 Mev, 988.2 ± 4.5 microns. (auth)

1183 UCRL-4519(Rev.)
California. Univ., Livermore. Radiation Lab.
SOME PHYSICAL PROPERTIES OF THE HYDRIDES. Robert E. Elson, Howard C. Hornig, William L. Jolly, John W. Kury, William J. Ramsey, and Allan Zalkin. June 1956. 56p. Contract W-7405-eng-48. $0.35(OTS).

The physical properties of all the hydrides for which data are known are tabulated. The properties listed include the simple thermodynamic functions of formation, the thermodynamic functions and temperatures for various processes (e.g., fusion, vaporization), dissociation or vapor pressure data, densities, and crystallographic data. (auth)

1184 WADC-TR-55-102(Pt. III)

Shell Development Co., Emeryville, Calif.

GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS. Final Report [for] September 1, 1955 through June 30, 1956. John B. Accinelli. Aug. 1956. 39. Project title: AIRCRAFT LUBRICANTS. Task title: LUBRICANT MECHANICAL EVALUATION. Contract AF33(616)-2443.

A summary of the final work done on grease lubricated anti-friction bearings at speeds of 1.0×10^6 DN and higher is reported. The work was performed on two 20 mm ultra high speed ball bearing rigs. Work with grease at 1.0 to 1.2×10^6 DN suggests that the interplay of mechanical factors such as rotor dynamic unbalance, bearing type, size and precision, load alignment, bearing-to-housing fits, etc., will affect performance more than changes in grease properties. Grease lubrication at these ultra high speeds appears to be affected considerably more by mechanical factors than is oil-air mist lubrication, indicating that grease lubrication must be inherently more marginal. One test at 1.0×10^6 DN with a grease meeting MIL-G-3278 ran well for 109 hours, thus demonstrating that under the proper conditions satisfactory long term lubrication with grease is possible. With all greases, operation of the rig at 30,000 rpm was significantly better than operation at 50,000 rpm. A grease containing silicone oil was poor at both speeds. (auth)

1185 WAPD-TH-219

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

REVIEW OF MARTINELLI-NELSON PRESSURE DROP CORRELATION. N. C. Sher. [July 1956]. 16p. $3.30 (ph OTS); $2.40(mf OTS).

The Martinelli-Nelson predictions of two-phase pressure drop due to head and momentum changes have been reviewed, and the underlying assumptions, postulates, and data are discussed. Modifications to the predicted void fraction values are proposed in order to eliminate the possibility of predicting slip ratios less than unity. The effect of the adjustment at 2000 psia on the boiling pressure drop data reported in WAPD-TH-204 is to bring the results from the data reductions according to the Martinelli and homogeneous models into even closer agreement. (auth)

1186

THERMODYNAMIC THEORY OF IRREVERSIBLE PROCESSES. II. SEDIMENTATION EQUILIBRIUM OF FLUIDS IN GRAVITATIONAL AND CENTRIFUGAL FIELDS. Donald G. Miller (Brookhaven National Lab., Upton, N. Y.). Am. J. Phys. 24, 555-61(1956) Nov.

Using results of the thermodynamic theory of irreversible processes, general equations are given for the transport of all charged and uncharged constituents of a multicomponent fluid situated in a gravitational or centrifugal field. From these equations, relations describing the special case of sedimentation equilibrium are derived. It is pointed out that the Onsager relations are not required in this case. Different integration paths lead to certain useful exact equations, one of which has been given recently by Young, Kraus, and Johnson. These equations may be used to obtain from sedimentation experiments (1) the activity as a function of the pressures and compositions associated with sedimentation equilibrium; (2) the activity as a function of composition at a given pressure if it is known at one composition and the same pressure and if partial molal volume and density data are known as a function of P; (3) the activity as a function of pressure for one composition if it is known as a function of composition at a single pressure, and conversely. (auth)

1187

BORON HYDRIDE MONITORING DEVICES EMPLOYING A TRIPHENYLTETRAZOLIUM CHLORIDE REAGENT. L. J. Kuhns, R. H. Forsyth, and J. F. Masi (Callery Chemical Co., Penna.). Anal. Chem. 28, 1750-2(1956) Nov.

Two instruments may be used to monitor atmospheres contaminated with boron hydrides: a portable, field model with a hand-operated pump and a continuous analyzer which automatically records boron hydride concentration. Both were designed to make use of the nonspecific reduction of triphenyltetrazolium chloride by boron hydrides to form the red-colored formazan. Metered air samples are passed through filter paper or cloth tape impregnated with the reagent solution. The red color produced is measured by visual means with the field model and by a differential reflectance photometer with the automatic instrument. The instruments were calibrated with diborane, pentaborane, and decaborane; although they are relatively insensitive to diborane, very low concentrations of pentaborane and decaborane can be detected. The field model can detect 0.1 p.p.m. of decaborane and 0.5 p.p.m. of pentaborane, while the automatic instrument is capable of detecting 0.1 p.p.m. of either compound. (auth)

1188

THE THERMAL AND ELECTRICAL CONDUCTIVITY OF LITHIUM AT LOW TEMPERATURES. H. M. Rosenberg (The Clarendon Laboratory, Oxford). Phil. Mag. (8), 1, 738-46(1956) Aug.

The thermal and electrical conductivity of two specimens of lithium has been measured in the range 2 to 90°K. At the lowest temperatures the ideal electrical resistivity is found to vary as $T^{3.5}$ and the lattice scattering term for the electronic thermal resistance is $1.8 \times 10^{-4} T^2$. These results and the value of the Lorenz number are compared with current theories. (auth)

1189

NORMAL MODES CHARACTERIZING MAGNETOELASTIC PLANE WAVES. Alfredo Baños, Jr. (Univ. of California, Los Angeles). Phys. Rev. 104, 300-5(1956) Oct. 15.

The general theory of magnetohydrodynamic waves in an ideal conducting fluid embedded in a uniform field of magnetic induction, and the application of the theory to the systematic analysis of the various modes of propagation in incompressible and compressible fluids have been presented by the author in two earlier papers. The techniques developed there have now been extended to the study of homogeneous plane waves in an unbounded conducting solid. It is found that, in the presence of a uniform static magnetic field, the elastic medium sustains five distinct modes of propagation as already pointed out by Knopoff. The first two modes are pure shear waves, one of which is a slightly attenuated shear mode with phase velocity modified anisotropically by magnetoelastic coupling, whereas the companion shear mode is highly attenuated and exhibits a propagation constant which is essentially that of an electromagnetic wave of the same frequency. The remaining three modes are shear-compression waves of which one mode exhibits a phase velocity intermediate between the phase velocity of shear and compressional waves, the second mode has a phase velocity exceeding that of compressional waves, and the third shear-compression mode is again highly attenuated with the propagation characteristics of an electromagnetic wave. (auth)

1190
GROWING ELECTRIC SPACE-CHARGE WAVES. J. R. Pierce and L. R. Walker (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 104, 306-7(1956) Oct. 15.

Some familiar aspects of the theory of growing space-charge waves are restated as a comment on recent criticism of this theory by J. H. Piddington. (auth)

1191
THE CONDENSATION OF A VAPOUR TO AN ASSEMBLY OF DROPLETS OR PARTICLES. K. Stewart (Atomic Energy Research Establishment, Harwell, Berks, England). Trans. Faraday Soc. 52, 161-73(1956) Feb.

Part of the debris resulting from an atomic explosion will be formed by the condensation of metal or metal-oxide vapor in air. A particle size distribution likely to be produced by nucleation and subsequent condensation and coagulation is deduced and discussed. (auth)

1192
KINETICS OF THE PHOTOCURRENT INCREASES AND THE EXTINCTION OF PHOTOCONDUCTIVITY IN CADMIUM SULFIDES. A. D. Shneider. Zhur. Tekh. Fiz. 26, 1428-32 (1956) July. (In Russian)

Monocrystals of CdS obtained by a condensation method from a gas phase were used. The specimens had linear or even weaker response to the light intensity. Volt-ampere characteristics of the crystals illuminated with intensity less than 20 v and down to 10^{-3} v agreed well with Ohm's law. The measurements showed the absence of any "photo-rectifying effect." (R.V.J.)

1193
THE THEORY OF ION BEAM COMPENSATIONS. I. THE THEORY OF VOLUME CHARGE COMPENSATION IN ION BEAMS IN STATIONARY CONDITION. V. S. Anastasevich. Zhur. Tekh. Fiz. 26, 1487-92(1956) July. (In Russian)

Previous experiments established the theory of the volume charge compensation in ion beams during their passage in rarefied gas, made by electrons formed by ionization of gas molecules. Special conditions (of gas pressure and beam geometry) were selected for stationary ion beams in which the electric field inside of the beam was sufficiently small so the flow of ions in the outer magnetic field was accepted without any volume charge. In previous evaluations of the compensation theory the secondary slow ions formed along with the electrons during the ionization were considered unimportant. However, the calculations presented here show that secondary ions play as important a part as the electrons in the beam compensation and decompensation processes. (R.V.J.)

1194
ON SOME ASYMMETRIC MAGNETIC FIELDS WITH DOUBLE FOCUSING. II. Yu. V. Vandakurov. Zhur. Tekh. Fiz. 26, 1599-1610(1956) July. (In Russian)

Focusing properties of asymmetric magnetic fields (conditionally accepted as fields in which the scalar magnetic potential is asymmetric to the median plane) with asymmetric rotation were studied for the case in which the basic trajectory of the beam in the median plane of the field was perpendicular to the radium in its initial point. Double-focusing fields with several intermediate images formed by focusing in the horizontal or vertical direction, appearing between the source and final image, were studied. Investigations showed large dispersion in the fields and the absence of second-order aberrations depending on the angular divergence of the beam in the median plane. (R.V.J.)

1195
ABSORPTION SPECTRA AND EXCITOR EMISSION IN CADMIUM SELENIDE CRYSTALS. E. F. Gross and V. V. Sobolev. Zhur. Tekh. Fiz. 26, 1622-4(1956) July. (In Russian)

Investigations revealed the luminscence spectra similarity in the crystals of CdS and CdSe. A group of equidistant narrow bands analogous to the well known CdS "green" luminescence was observed in both spectra, with the spacing between the bands as $\Delta\nu = 182\ cm^{-1}$. A group of lines similar to CdS "blue" luminescence was also found for the CdSe crystals. Investigations of absorption and luminescence spectra for the CdS and CeSe showed that lines and bands of absorption and emission, in both cases, have different polarization. (R.V.J.)

ASTROPHYSICS

1196
ORIGIN OF THE ELEMENTS IN STARS. F. Hoyle, William A. Fowler, G. R. Burbidge, and E. M. Burbidge. Science 124, 611-14(1956) Oct. 5.

A qualitative outline is given of the essentially separate mechanisms which are required in stellar synthesis of the elements. Included are discussions of the thermal conversion of pure H through He to Fe, thermal reactions of H and He with light elements, and stellar surface reactions. (B.J.H.)

COSMIC RADIATION

1197 NP-6134
Southern Illinois Univ., Carbondale.
THE FLUX OF HEAVY PRIMARY NUCLEI WITH CHARGE GREATER THAN OR EQUAL TO TEN AT VARIOUS LATITUDES AND ALTITUDES (thesis). Taek-Soon Yoon. May 1956. 34p.

The identification of the heavy primary particles and the determination of their interaction mean free paths in air and of flux values at different altitudes and latitudes above 55,000 feet are reported. (F.S.)

1198
A SURGE OF COSMIC RAYS OF HIGH INTENSITIES OBSERVED FEBRUARY 23, 1956 IN MOSCOW, SVERDLOVSK, TBILISI, AND CAPE SCHMIDT. L. I. Dorman, N. S. Kaminer, V. K. Koiava, and B. F. Shvartsman (Research Inst. of Earth Magnetism). Doklady Akad. Nauk S.S.S.R. 108, 809-12(1956) June 11. (In Russian)

1199
CLOUD CHAMBER ANALYSIS OF COSMIC-RAY SHOWERS UNDER 10 TO 23 CM OF LEAD. P. K. Sen Choudhury and S. N. Sengupta (Presidency Coll., Calcutta). Indian J. Phys. 30, 455-63(1956) Sept.

A counter-controlled cloud chamber study of different types of showers in Pb under 10 to 23 cm. was made to investigate the controversial existence of higher maximum in the Rossi curve and to identify the radiation and the mechanism that might contribute to the formation of such a maximum. (F.S.)

1200
DIRECTIONAL INTENSITIES OF POSITIVE AND NEGATIVE MESONS IN THE ATMOSPHERE. F. B. Harris (Syracuse Univ., Utica, N. Y.) and I. Escobar V. (Laboratorio de Física Cósmica, La Paz, Bolivia). Phys. Rev. 104, 542-4 (1956) Oct. 15.

μ-meson intensities at zenith angles of $22\frac{1}{2}°$ and $67\frac{1}{2}°$ at Chacaltaya, Bolivia are found to be in good agreement with the theory given by Harris and Escobar. Data taken at zenith angles of 45° at Echo Lake, Colorado confirm that part of the theory which describes the effect of the terrestrial magnetic field on the μ mesons after their production in the atmosphere. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1201 NP-6146

Detroit. Univ.

THE STUDY OF PROPERTIES OF SINGLE CdS AND ZnS CRYSTALS FOR USE AS DETECTORS AND CRYSTAL COUNTERS. Technical Progress Report No. 2 [for] September 1, 1955 to August 31, 1956. W. M. Baker, R. C. Crane, S. J. Czyzak, B. P. Farrand, J. B. Howe, D. J. Lacombe, R. O'Keefe, and H. Payne. Oct. 1956. 56p. Project No. NR-015-218. Contract Nonr-1511-(01).

Progress is reported on a theoretical and experimental study of the properties of single crystals for use as detectors and crystal counters. A procedure for growing single synthetic crystals of CdS and ZnS is discussed. The optical, electrical, and structural properties of CdS and ZnS were studied. Measurements of the index of refraction, absorption coefficient, dielectric constant, dissipation factor, and lattice parameters of the unactivated and activated crystals were made. (For preceding period see NP-5791.) (J.H.M.)

1202 ORNL-2192

Oak Ridge National Lab., Tenn.

OPTICAL PROPERTIES AND X-RAY DIFFRACTION DATA FOR SOME INORGANIC FLUORIDE AND CHLORIDE COMPOUNDS. H. Insley, T. N. McVay, R. E. Thoma, and G. D. White. Nov. 8, 1956. 68p. Contract W-7405-eng-26. $0.45(OTS).

Optical properties and x-ray-diffraction data on fluorides and chlorides discovered during some phase equilibrium studies are presented. (T.R.H.)

1203 OSR-TN-56-524

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

A STUDY OF DIRECT METHODS OF CRYSTAL STRUCTURE DETERMINATION. Final Report. Covering the Period of July 1, 1954 to September 1, 1956. Leonid V. Azaroff. Aug. 31, 1956. 65p. Project No. R 355-40-18. Contract AF18(600)-1168. (AD-110342).

The study of direct methods of crystal structure determination was carried out with the aid of a single crystal of fairfieldite. This particular crystal was chosen because its structural composition was such that it could not adversely influence this investigation. The first method tested, the Hauptman-Karle statistical method, was found to be limited in its applicability to structures which could alternatively be solved by simpler methods. Methods employing inequalities were found to be limited to structures consisting of a small number of similar atoms. The vector shift methods emerged from this investigation as the only ones promising universal applicability. There are several difficulties which presently limit their utilization. These limitations, as well as the detailed evaluations of all the methods, are described. Suggestions for extending the usefulness of vector shift methods are also given. In an effort to evaluate the direct methods under the best possible conditions, a new method of measuring diffraction intensities was developed. This arrangment uses a bent-crystal monochromator in conjunction with conventional cameras. It has been shown that this photographic arrangement gives intensity values with an accuracy and sensitivity rivaling more elaborate arrangements employing ionization-counter detectors. (auth)

1204

X-RAY STUDIES OF MATTER AT PRESSURES UP TO 30,000 ATMOSPHERE. L. F. Verishchagin and I. V. Brandt (Lab. of High Pressures in Physics). Doklady Akad. Nauk. S.S.S.R. 108, 423-4(1956) May 21. (In Russian)

Analysis of radiograms made of Bi under 30,000 atm. pressure show that changes in Bi volume (drop of 8.6%) were not related to the transition of electrons inside of the atom but to the changes in crystalline structure. (R.V.J.)

1205

X-RAY STUDIES OF PLASTIC PROPERTIES OF BERYLLIUM MONOCRYSTALS. R. I. Garber, I. A. Gindin, V. S. Kogan, and B. G. Lazarev. (Physico-Technical Inst. Academy of Science, USSR). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 639-40(1956) June. (In Russian)

X-ray-diffraction studies were made of beryllium monocrystals compressed at 253 to 800° (liquid hydrogen temperature). Metallographic and microinterferrometric analysis of deformed surfaces of beryllium monocrystals and Lauergrams are presented. (R.V.J.)

1206

X-RAY MEASUREMENTS OF THE THERMAL EXPANSION OF TRIGONAL POTASSIUM, LITHIUM, AND SILVER NITRATES. H. F. Fischmeister (Univ. of Uppsala, Sweden). J. Inorg. and Nuclear Chem. 3, 182-6(1956) Oct.

The thermal expansion of the trigonal high-temperature modifications of $LiNO_3$, KNO_3 and $AgNO_3$ has been measured. Cell constants at the transition and melting points and expansion coefficients are tabulated for the three salts and for $NaNO_3$. The expansion of these crystals is strongly anisotropic, being greatest along the hexagonal c-axis. For KNO_3, the expansion perpendicular to this axis was found to be slightly negative. (auth)

1207

AN X-RAY STUDY OF NATURAL MONAZITE. II. SINGLE CRYSTAL DATA ON INDIAN MONAZITE MINERAL. Jagdish Shankar and P. G. Khubchandani (Atomic Energy Establishment, Bombay). Proc. Indian Acad. Sci. 44A, 130-3(1956) Sept.

A study is reported of single crystals of natural thorium-bearing monazite. The cell dimensions and indices of reflecting planes obtained from the rotation and Weissenburg photographs are given. (auth)

ELECTRONS

1208

RADIATION EFFECTS ON ELECTRON OSCILLATIONS IN AN ALTERNATING GRADIENT SYNCHROTRON. A. N. Matveev (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 108, 432-5(1956) May 21. (In Russian)

Comparative studies are made of strong and soft focusing effects in radiation-induced electron oscillations of several-Bev electrons. Results showed a considerable attenuation in the amplitude of electron oscillation strong focusing and confirmed the previously offered theory that a transition from soft focusing to strong focusing takes place in radiation-induced betatron oscillations of electrons of several Bev order. (R.V.J.)

1209

SECONDARY ELECTRON EMISSION FROM METALS UNDER THE BOMBARDMENT BY IONS AND NEUTRAL PARTICLES. V. G. Tel'kovskiĭ. Doklady Akad. Nauk S.S.S.R. 108, 444-6(1956) May 21. (In Russian)

Measurements were taken of the secondary electron emission from the surface of pure Mo, Zr, Ni, Ta, Cu, and C bombarded by ions of H, He, N, Ni, A, and Mo and neutral atoms of inert gases with energies up to 120 kev. The best results were obtained from Mo and Zr targets due to the high purity and strong dehydration of these specimens. Thresholds of secondary emission, in the velocity range of 0.5 to 2×10^7 cm/sec, with little dependence on the type of

the target material or the type of ions were revealed by experiments. Analysis of the graph showed that secondary electron emission is determined only by the energy of the falling particle and not by the magnitude of the ion charge. Measurements showed that under similar conditions, secondary electron emission bombarded by neutral atoms coincided, within permissible error, with secondary electron emission bombarded by ions. (R.V.J.)

1210

ON SOME PROBLEMS IN ELECTRON BEAM FOCUSING THEORY. P. P. Kas'yankov (Ul'yanov-Lenin Leningrad Electrotechnical Inst.). Doklady Akad. Nauk. S.S.S.R. 108, 813-16(1956) June 11. (In Russian)

1211

ABNORMAL ROTATION IN RADIATIVE COLLISION OF ELECTRONS WITH WATER MOLECULES. Tadao Horie, Takayuki Nagura, and Masamoto Otsuka (Osaka Univ., Japan). Phys. Rev. 104, 547-8(1956) Oct. 15.

Purely electronic impacts of H_2O molecules were investigated in order to obtain information on the mechanism of the abnormal rotation observed in electrical discharges through water vapor. Descriptions are included of the collision chamber used, and the observed rotational intensity distributions are shown. (B.J.H.)

GASES

1212 AECU-3299

Syracuse Univ., N. Y. Research Inst.

SATURATION COMPOSITION OF STEAM–HELIUM–WATER MIXTURES PVT DATA AND HEAT CAPACITY OF SUPERHEATED STEAM–HELIUM MIXTURES. Final Report. James A. Luker and Thomas Gniewek. July 29, 1955. 117p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-557F). $18.30(ph OTS); $6.00(mf OTS).

The saturation composition of the steam–helium–liquid water system at 300°C and 2000 psia was determined. Saturation mixture composition was determined to be 70.54 mol. % H_2O and 29.46 mol. % He within a standard deviation of ±0.23%. This composition may be accurately predicted by use of Dalton's Law with the constituents' PVT data. Prediction is within 0.06M % of experimental results. The PVT properties of the above mixture were then investigated in the superheated region. A pressure range of 700 to 2400 psia and a temperature range of 550 to 950°F was covered. Various methods of predicting experimental results were tried. Dalton's Law used with constituents' PVT data was successful in predicting mixture PVT data to within an average 1.11%. It also predicted saturation conditions to within an average 1.56%. Based on the correlation of the experimental data and data predicted by Dalton's Law, enthalpy-temperature isobars and heat capacity-temperature isobars were calculated for the mixture. The isobars covered a pressure range of 1000 to 2000 psia and a temperature range of 550 to 950°F. (auth)

1213 AECU-3301

Syracuse Univ., N. Y. Research Inst.

VISCOSITY OF GAS MIXTURES. Final Report. Charles A. Johnson. July 1, 1956. 127p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-566F3). $19.80(ph OTS); $6.30(mf OTS).

Procedures were investigated for estimating gas viscosity data for mixtures and pure gases at atmospheric and higher pressures. An equation was derived by modifying empirically an existing mixture viscosity equation. Viscosities calculated from the resultant equation were compared with experimental data for four typical gas mixtures. The results thus calculated were less accurate than similar values obtained by computations using the rigorous statistical mechanical equation but the calculations were far less time-consuming. It was undertaken to modify the low pressure equation and also the statistical mechanical mixture viscosity equation to account for the increase in viscosity with increasing pressure. Because of the lack of experimental viscosity data for mixtures at elevated pressures, a steady-flow type capillary viscosimeter was constructed and viscosities of pure He, pure O_2, three $He-O_2$ mixtures, a steam–helium mixture and a steam–oxygen mixture were measured. The ranges of pressure and temperature were 20 to 136 atmospheres and 200 to 450°C. The accuracy of the results was approximately ±1%. Viscosities calculated from the proposed equation and the modified statistical mechanical equation were compared with these data. Some experimental data in the literature on a nitrogen–methane system and also on air at elevated pressures were also used for comparison. A summary of the comparisons is given. (auth)

1214 AECU-3302

Syracuse Univ., N. Y. Research Inst.

DETONATION, EXPLOSION AND REACTION LIMITS OF SATURATED STOICHIOMETRIC HYDROGEN–OXYGEN–WATER MIXTURES. Final Report. Irvin M. Macafee, Jr. July 1, 1956. 86p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-566F4). $13.80(ph OTS); $4.80(mf OTS).

The reaction, explosion, and detonation limits of saturated stoichiometric H_2-O_2 mixtures were determined at 100 and 200°C in one geometrical configuration. Saturation mixture composition was calculated from thermodynamic properties of stoichiometric H_2 and O_2 and H_2O vapor using partial molal densities (lb. mole/ft^3) as the factor representing the relative proportions of each component. The reaction limits were determined from the amount of pressure drop occurring from reaction of saturated gas mixtures. The limits are not sharply defined but are indicative of the general boundary limits for no reaction, partial reaction, explosion, and detonation. In general, reaction limits increase with increase in temperature, this increase being small with temperatures up to 200°C. The lower boundary limits for partial reaction, explosion, and detonation as determined in this study were respectively 22.4%, 44% and 50% for mixtures at 100°C and 22.8%, 47% and 52% for mixtures at 200°C. Compositions are expressed as percentages of $2H_2-O_2$. (auth)

1215 LA-1962

Los Alamos Scientific Lab., N. Mex.

SOME SOLUTIONS OF THE DIFFUSION EQUATION. John C. Holladay. Sept. 1955. 23p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

Except for a slowly varying logarithmic factor, the diffusion of a perfectly ionized gas at constant temperature across a magnetic field has been given by $\partial n/\partial t$ being proportional to $\nabla \cdot (n\nabla n/B^2)$. An attempt is made to find similarity solutions to this equation for one-dimensional geometries. The two geometries considered in this paper are plane and cylindrical geometries. All such solutions to this equation of the form $n(x,t) = f[xh(t)]\, g(t)$ are found for the following two assumptions: B^2 may be considered as constant (as an approximation because of a low density); and B^2, because of static equilibrium, is non-trivially linearly dependent on n. In other words, $B^2 = B_0^2(1-\beta)$ where B_0^2 is constant. (auth)

1216 AEC-tr-2667

THE FLUORESCENCE OF GASES DURING DECELERA-

TION OF FAST PARTICLES: SPECTROSCOPIC EXAMINATION. A. F. Gruen. Translated by W. G. Olsher from Z. Naturforsch. 9a, 55-63(1954). 12p.

The mechanism of excitation of various gases by fast particles (50 Kv electrons, 600 Kv protons and hydrogen molecule ions) is discussed. This mechanism is then used to explain the excitation spectra of N_2, O_2, H_2, A, A–N_2, and Xe–N, measured in the experiment. (T.R.H.)

1217

HELIUM-3 AND THE LIQUID HELIUM PROBLEM. E. F. Hammel (Los Alamos Scientific Lab., N. Mex.). Ind. Eng. Chem. 48, 2005-11(1956) Nov.

Theories which attempt to explain the behavior of liquid He are reviewed. The study of He^3 may assist in the solution of the problem. (T.R.H.)

1218

THE DIFFUSION OF FISSION KRYPTON FROM METALLIC URANIUM. Myron B. Reynolds (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 1, 374-82 (1956) Oct.

The rare gases have not been shown to exhibit measurable equilibrium solubility in metals, nor do any common metals exhibit measurable permeability to the rare gases. By means of nuclear reactions, however, "solid solutions" of rare gases in metals may be produced which permit the rare gas diffusion process to be studied. Results of work on the system radiokrypton–uranium are presented. Diffusion of radiokrypton from small cylinders of irradiated normal uranium was found to be negligible at temperatures below 1000°C. The diffusion rate was found to be quite temperature-sensitive and was considerably enhanced by thermal cycling. Swelling of the metal specimen during the diffusion process and the fact that the theoretical time dependence was never observed, leads to the conclusion that gas escape is by way of grain boundaries or microcracks. A possible mechanism to explain the thermal cycling behavior is presented. (auth)

INSTRUMENTS

1219 CU-150

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. Pegram Lab.

A HIGH TRANSMISSION MECHANICAL NEUTRON-MONOCHROMATOR FOR FILTERING OF HIGHER ORDER REFLECTIONS. N. Holt. June 1, 1956. 14p. Contract AT-30-1-GEN-72. $3.30(ph OTS); $2.40(mf OTS).

The construction of a mechanical neutron monochromator for the cold neutron region with 80% transmission is described. The apparatus is specially designed to be used in connection with a neutron crystal spectrometer for filtering out higher order reflections by placing it between the crystal and the counter. An experimental test of the machine has been performed by measuring the gold cross section and the neutron intensity as a function of the angular velocity of the rotor for a certain wavelength. The result shows that no higher order neutrons are transmitted. (auth)

1220 HW-36217

Hanford Atomic Products Operation, Richland, Wash.

AN ELECTRICAL TECHNIQUE FOR GROUND WATER VELOCITY MEASUREMENT. J. R. Raymond. Apr. 11, 1955. Changed from OFFICIAL USE ONLY Aug. 15, 1956. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

An electrical conductivity technique was developed to determine the dilution-displacement rate of an electrolyte in a well from which data the velocity of the water through the well can be calculated. The electrical current flow between two electrodes in a well drops proportionately with the dilution and the displacement of the electrolyte by fresh water entering the well. The drop of electrical current flow over a period of time was applied to a derived equation to obtain a value for ground water velocity. The technique gives results comparable to other methods and some problems of the standard methods of measuring ground water velocity are eliminated. However, a correction factor for porosity of the aquifier must be used in the derived equation. Porosity values are not adequately known in most cases, therefore the ground water velocity figures are generally relative rather than absolute. (auth)

1221 IGR-R/CA-188

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.

A FIFTY-FOUR CHANNEL RECORDER. E. Duncombe and W. Jaques. Aug. 22, 1956. 26p. (IGC-TRDC/P-183).

A commercial strip-chart potentiometric recorder has been modified so that it can display the change with time of each of fifty-four similar variables. Each channel record is made in one of fifty-four areas of the chart face, so that each record is exhibited separately. The channel identification is controlled and actuated by electrical means at the remotely-positioned channel selection switch. (auth)

1222 USNRDL-TR-111

Naval Radiological Defense Lab., San Francisco.

A NINE-CHANNEL TIME ANALYZER FOR MEASURING SHORT HALF-LIFE ACTIVITIES IN THE MILLISECOND REGION. R. A. Taylor. Sept. 19, 1956. 12p. Project NS-081-001.

A nine-channel time analyzer has been constructed and used to measure radiations from radioactive isotopes whose half lives are of the order of magnitude of a few milliseconds. It is operated in association with a Van de Graaff generator, the beam of which is pulsed. (auth)

1223 AEC-tr-2682

A PRECISION TRANSITOMETER. L. Gierst. Translated by K. S. Bevis from Anal. Chim. Acta 15, 262-70(1956). 12p.

A detailed description is given of a precision transitometer, utilizing a dropping mercury electrode with a controlled surface. The principle of operation and operating characteristics is discussed. The apparatus is atuomatic, and yields rapid results with an error of about 0.2%. (J.H.M.)

1224

A TEN-CHANNEL TIME ANALYSER. P. K. Iyengar (Atomic Energy Establishment, Bombay). J. Sci. Ind. Research (India) 15A, 399-400(1956) Sept.

A stable ten-channel time analyzer with channel widths variable from 10 to 300 μ sec for use in scalers is described. (C.H.)

1225

AN AUTOMATIC ELECTROMECHANICAL STRESSING UNIT FOR CREEP AND FATIGUE TESTING. A. J. Kennedy and R. F. Slade (British Iron and Steel Research Assoc., London). J. Sci. Instr. 33, 409-10(1956) Nov.

The apparatus is designed to apply a complex creep and fatigue stressing program to a metal test-piece. A new electrical system has been developed which controls the extension of a mechanical spring in such a way that the test proceeds automatically under either constant stress or constant load, as required. The creep strain and the stress error are recorded during the test. The same system may be used to conduct creep recovery or stress relaxation tests. (auth)

ISOTOPES

1226 CF-55-1-22

[Oak Ridge National Lab., Tenn.]

ESTIMATE OF THE COST OF PRODUCING NITROGEN-15 BY CHEMICAL EXCHANGE: NITRIC ACID–NITRIC OXIDE SYSTEM USING SULFUR DIOXIDE REFLUX. B. B. Klima, W. T. Ward, R. R. Wiethaup, and J. S. Drury. Jan. 14, 1955. 48p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

At a production rate of 1 lb/day it is estimated that 95% N^{15} may be produced for $4.21/g. The estimate assumes no loss of enriched material in the refluxers, production of 60° Be. H_2SO_4, and proximation to a cheap SO_2 source. (T.R.H.)

1227 ORNL-2138

Oak Ridge National Lab., Tenn.

CHEMICAL AND ISOTOPIC STUDIES OF THE CLOSED-CYCLE CARBONATE SYSTEM FOR N^{15} ENRICHMENT. A. A. Palko, L. L. Brown, G. M. Begun, and E. F. Joseph. Nov. 8, 1956. 25p. Contract W-7405-eng-26. $0.25(OTS).

The isotopic exchange reaction between gaseous NH_3 and $(NH_4)_2(CO_3)$ solution saturated with dissolved NH_3 has been studied. Rapid exchange was found between carbamate ion and the other nitrogen species present. The effective separation factor at atmospheric pressure determined from single-stage equilibrations was found to be 1.015 at 15.6°C, 1.019 at 25.8°C, 1.021 at 35.9°C, and 1.022 at 44.3°C. Calculations from the data gave the following values for the separation factor between gaseous NH_3 and carbamate ion: 1.023 at 15.6°C, 1.021 at 25.8°C, 1.021 at 35.9°C, and 1.019 at 44.3°C. In both exchange reactions, N^{15} concentrates in the aqueous phase. Column studies were made and found to be in agreement with these data. Batch experiments and column studies of the use of calcium hydroxide slurry for the reflux reaction with ammonium carbonate solution showed that the difficulties encountered could be overcome and that the NH_3 could be satisfactorily stripped from the waste solution. Operation at atmospheric pressure, good separation factor, and recycle of reflux chemicals make this system an attractive one for the economical production of N^{15}. (auth)

1228

PRODUCTION AND PROPERTIES OF C^{15}. R. A. Douglas, B. R. Gasten, and Ambuj Mukerji (Univ. of Wisconsin, Madison). Can. J. Phys. 34, 1097-1111(1956) Nov.

Uniform thin C^{14} targets on 2500 A nickel backings were prepared in a discharge tube containing acetylene (enriched to 28.8% C^{14}). A NaI(Tl) crystal was used to measure the yield of C^{15} (2.25 ± 0.05 sec half life) from $C^{14}(d,p)\ C^{15}$ from E_d = 1.3 to 3.0 Mev. A 7.5 ± 1.5 sec activity was also observed, presumably N^{16} produced by $C^{14}\ (d,\gamma)\ N^{16}$. The C^{15} gamma-ray spectrum indicates only a 5.3-Mev transition. A plastic scintillator was used to measure the C^{15} beta spectrum. End-point energies of 9.5 ± 0.3 and 4.5 ± 0.2 Mev with a branching ratio of 4 to 1 favoring the lower energy component were observed. The results are consistent with a spin and parity assignment of $^1/_2(+)$ for the C^{15} ground state. (auth)

ISOTOPE SEPARATION

1229 NYO-6242

Columbia Univ., New York.

SEPARATION OF ISOTOPES. Annual Progress Report [for] July 1, 1954 to July 1, 1955. Dept. of Chemistry. T. I. Taylor. July 1, 1955. (Includes reprint: SEPARATION OF NITROGEN ISOTOPES BY CHEMICAL EXCHANGE BETWEEN NO AND HNO_3. W. Spindel and T. I. Taylor. J. Chem. Phys. 23, 981-2(1955).) 135p. Contract AT(30-1)-755. (CU-77-55-AT(30-1)-755-Chem.) $0.65 (OTS).

The exchange of N^{15} between HNO_3 and NO appears to be attractive for large scale production of N^{15}. Experiments are described which led to this conclusion. The equilibria are determined and plant scale production conditions set up. Chemical exchange effects on isotope separation in thermal diffusion columns are discussed. (For preceding period see NYO-6239.) (T.R.H.)

MASS SPECTROGRAPHY

1230

ISOTOPIC ANALYSIS OF ALKALI ELEMENTS WITH THE AID OF SYNTHETIC ALUMINO SILICATE ION SOURCE. G. M. Panchenkov, P. A. Akishin, N. N. Vasil'ev, O. T. Nikitin, and S. D. Moiseev (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 30, 1380-6(1956) June. (In Russian)

Descriptions are given for a new method of mass spectrometric analysis of Li, K, and Rb with the aid of synthetic aluminosilicate ion source. The possibility of employing the natural isotopic ratio of K^{39}/K^{41} as secondary standard for calibrating the apparatus on analysis of other elements has been demonstrated. An attempt was made to determine the true isotope composition of Li in LiCl, calibrating the apparatus according to the K isotope ratio. The value for Li^7/Li^6 has been found to be 12.3 ± 0.1. (tr-auth)

MATHEMATICS

1231 CRT-671

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE PROGRAMMER'S GUIDE TO THE CHALK RIVER DATATRON. J. M. Kennedy. Oct. 1956. 35p. (AECL-368).

Information is given to guide programmers in the use of the Chalk River Datatron Computer. Discussions are included of the various parts of the computer and additional equipment, the order code, programming, checking of programs and console procedure, and timing. (J.H.M.)

1232 IDO-14345

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

OPERATIONS EVALUATION AT THE IDAHO CHEMICAL PROCESSING PLANT OF THE U. S. ATOMIC ENERGY COMMISSION. Frank P. Vance and Fred H. Tingey. June 29, 1955. 30p. Contract AT(10-1)-205. $4.80(ph OTS); $2.70(mf OTS).

Statistical analysis is applied to correlation of plant-scale operating variates with examples from ICPP. (T.R.H.)

1233 NDA-15C-87

Nuclear Development Corp. of America, White Plains, N. Y.

OPERATING INSTRUCTIONS FOR NUPAK. J. Certaine and M. Sullivan. Dec. 23, 1955. 40p. Contract AT(30-1)-862. $6.30(ph OTS); $3.00(mf OTS).

Operating instructions are given for a UNIVAC code (NUPAK), which computes the moments of the neutron angular flux from a plane isotropic continuous energy source in an infinite homogeneous medium and reconstructs (from the moments) the total flux. (auth)

1234 NYO-6484

New York Univ., New York. Atomic Energy Commission Computing Facility.

THE NYU MATRIX CODES. Raquel H. Dykaar and C. Donald La Budde. Mar. 15, 1956. 84p. Contract AT(30-1)-1480. $13.80(ph OTS); $4.80(mf OTS).

A number of matrix routines have been written to aid programmers in performing certain matrix manipulations required for problems currently under consideration. This report is a description of the matrix routines written thus far and the mathematical methods employed by them. (auth)

1235 NYO-7692

New York Univ., New York. Atomic Energy Commission Computing Facility.

THE NYU OMNIFAX COMPILER AND LIBRARY OF SUBROUTINES. Florence F. Ragusa and Sandra Zucker. Oct. 15, 1956. 37p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

All aspects of the use of the New York University Omnifax compiler are described, and a complete index of the NYU library of subroutines currently available for use with the compiler is given. (J.H.M.)

1236 AEC-tr-2659

SCIENTIFIC ANNUAL MEETING OF THE GAMM [ASSOCIATION FOR APPLIED MATHEMATICS AND MECHANICS], HELD AT BERLIN DURING THE PERIOD FROM MAY 31 TO JUNE 4, 1955. Translated by Lauritz S. Larsen. 46p.

Applied mathematics, mechanics, and fluid dynamics are discussed. Included are discussions on various differential equations and partial differential equations. (J.H.M.)

1237 AEC-tr-2689

USE OF CONTINUED FRACTIONS FOR DISCOVERING SOLUTIONS OF INTEGRAL EQUATIONS. I. M. Stesin. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 105, 225-8(1955). 8p.

Refer also to abstract 1314.

MEASURING INSTRUMENTS AND TECHNIQUES

1238 AECU-3263

Los Alamos Scientific Lab., N. Mex.

PILOT PLANT PREPARATION OF CADMIUM OCTOATE AS A TRIETHYLBENZENE SOLUTION. Robert K. Rohwer. [1956?]. 2p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

A procedure is presented for the preparation of cadmium octoate of sufficient purity for use in triethylbenzene-base liquid scintillators. (W.L.H.)

1239 DP-142

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A SURVEY METER WITH AN EXTENDED PROBE. C. E. Flanagan, Jr. and R. T. Nowak. Dec. 1955. 8p. Contract AT(07-2)-1. $1.80(ph OTS); $1.80(mf OTS).

A survey meter with an extended probe was designed to measure radiation intensities of 1 mr per hr to 30 r per hr. Because hot-filament tubes are not required, the battery life approaches shelf life. (auth)

1240 DP-145

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A MONITOR FOR LOW-LEVEL RADIOACTIVITY IN LIQUID STREAMS. E. C. Wingfield and P. R. Liller. Jan. 1956. 14p. Contract AT(07-2)-1. $3.30(ph OTS); $2.40 (mf OTS).

A continual monitor for low-activity water streams is described. The monitor automatically collects constant-volume samples of the water, evaporates the samples to dryness, and presents the residues to two scintillation counters. It can reliably detect, within ten minutes, an α activity of 5.2×10^{-11} curie/ml, a β activity of 7.3×10^{-9} curie/ml, and/or a γ activity of 3.3×10^{-9} curie/ml. (auth)

1241 HW-39142

[Hanford Atomic Products Operation, Richland, Wash.]

A TRANSISTORIZED GM SURVEY INSTRUMENT. W. G. Spear. Jan. 5, 19[56]. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A portable GM survey instrument was designed and developed which consists of a single transistor blocking-oscillator high voltage supply, a dual transistor multivibrator count-rate meter and a standard 30 mg/cm^2 glass-wall GM tube. The instrument has a sensitivity that is comparable to the common vacuum tube-type GM instruments and it gives both visual and aural indication. A high-temperature test at 160°F and 30% relative humidity produced no faulty operation. The battery complement, consisting of nine RM-12 1.3 volt mercury cells, gave a life use in excess of 400 hours continuous operation. The counting rate ranges are 0 to 1000, 0 to 10,000 and 0 to 100,000 counts per minute. (auth)

1242 HW-39338

[Hanford Atomic Products Operation, Richland, Wash.]

AN ALPHA, BETA, GAMMA TRANSISTORIZED SURVEY METER. W. G. Spear. Feb. 10, 1956. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A light weight, compact, transistorized, long battery life, α, β, and γ-survey instrument design is presented. (T.R.H.)

1243 HW-39431

[Hanford Atomic Products Operation, Richland, Wash.]

PORTABLE SCINTILLATION ALPHA SURVEY INSTRUMENT. W. G. Spear. [Oct. 7, 1955]. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The scintillation alpha counter is further developed and modified for longer term reliability and ease of maintenance. (T.R.H.)

1244 NYO-4664

New York Operations Office. Health and Safety Lab., AEC.

A METHOD FOR THE DETERMINATION OF RADON IN WATER. James Fresco, Edward Hardy, and John Harley. Nov. 1955. 28p. $4.80(ph OTS); $2.70(mf OTS).

A rapid and simple procedure for the determination of Rn in water is presented. The analysis is performed indirectly by scavenging the short-lived daughters with Pb precipitated as the sulfide, and counting the alpha radiation from RaC'. Theoretical decay curves for Rn daughters and Rn are included. The recovery determined from Rn-spiked solution is satisfactory and the reproducibility for successive water samples is good. Techniques for the elimination of long-lived interfering nuclides are discussed. Preliminary investigations indicate that the chemical procedure in conjunction with a Samson alpha survey meter is feasible for in-the-field studies. (auth)

1245 RIB-12

David Sarnoff Research Center, Princeton, N. J.

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. Quarterly Report No. 22 [for] November 1, 1955–January 31, 1956. R. H. Anderson, G. O. Fowler, M. H. Greenblatt, and A. H. Sommer. Feb. 17, 1956. 15p. [For Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract 308. $0.20(OTS).

Progress in the development of multi-alkali photocathodes is reviewed. Results of measurements of the

thermionic emission of the various photocathodes are included. Preliminary designs are given for a fast high-gain photomultiplier. Photoelectron collector systems are reviewed. Time resolution measurements of secondary emission multiplier structures are discussed. (For preceding period see AECU-3138.) (B.J.H.)

1246 RIB-14

DuMont (Allen B.) Labs. Inc., Tube Research Labs., Passaic, N. J.

DEVELOPMENT OF DUMONT PHOTOMULTIPLIER TUBES. Report No. 19 [for] September 1, 1955 to December 1, 1955. B. R. Linden, P. A. Snell, and F. W. Schenkel. 14p. Contract AT(30-1)-1336. $0.20(OTS).

Eliminating the problem of dark current in large phototubes is discussed. Experiments using a 16 in. phototube and a 12½ in. split cone tube were conducted to determine the proper positioning of the first dynode with respect to the photocathode. A number of ¾-in. diameter 10 stage tubes were constructed, and data are summarized. Linear photomultiplier structures have been considered, and steps were taken to determine the various characteristics of such structures. Transit time speed studies are included, and a diagram of a transit time measurement system is given. Tubes using Al–Be dynodes were constructed, and gains were computed for a given voltage. (For preceding period see AECU-3112.) (J.H.M.)

1247 RIB-17

David Sarnoff Research Center, Princeton, N. J.

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS; A REPORT ON PHOTOMULTIPLIER TUBE DEVELOPMENT. Quarterly Report No. 24 [for] May 1, 1956–July 31, 1956. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. 14p. [For Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract 308. $0.20(OTS).

Measurements of time resolution in various existing photomultipliers are reviewed. Studies were also continued on multiplier structures with improved time resolution. Relative delays in 6810 type structures are shown in graphical form. Design studies on a 9-in. diameter multiplier photocathode were continued. (For preceding period see RIB-13.) (B.J.H.)

1248 AEC-tr-2680

NEW TYPES OF IONISATION CHAMBERS AND THEIR APPLICATION TO THE STUDY OF RADIOACTIVE MINERALS. U. Facchini. Translated by R. J. Pease from Energia Nucleare (Milan) 3, 182-7(1956). 6p.

An abstract of this report appears in Nuclear Science Abstracts as NSA 10:10343. (J.E.D.)

1249

RADIATION DOSIMETRY USING ALKALI HALIDE CRYSTALS AND THE ABSORPTION OF BETATRON BREMSSTRAHLUNG IN WATER AND BONE. D. Kahn (Norwegian Radium Hospital, Oslo). Acta Radiol. 46, 563-9(1956) Sept.

The use and behavior of alkali halide crystals in measuring roentgen and γ radiation was investigated. Dosimeters containing single crystals and powdered crystals of KBr were constructed and irradiated with 175 kev roentgen and 31 Mev γ-rays Bremsstrahlung from the Institute's betatron. The response of this dosimeter relative to a Victoreen type thimble chamber was found to be approximately five times greater when irradiated with 175 kev roentgen rays than when irradiated by 31 Mev Bremsstrahlung. The response ratio was unchanged by lowering the maximum energy of the betatron from 31 Mev to 16 Mev. The measurement of the linear absorption coefficient of 31 Mev Bremsstrahlung in water and bone was carried out. The results agreed with values obtained with an air chamber in the case of water, and were in agreement with theoretical expectations in the case of bone. (auth)

1250

METHOD OF MEASURING VARIATIONS IN THE DISTANCE BETWEEN DIFFERENT POINTS IN AN EXTENSIBLE OBJECT SITUATED INSIDE AN OPAQUE ENCLOSURE. A. P. Pages (to Soc. Alsacienne de Constructions Mecaniques (France)). British Patent 754,012. Nuclear Eng. 1, 316 (1956) Oct.

A radioactive marking is used for checking the variations in the position of cable elements (pairs or quads) inside a telecommunication cable protected by a lead sheath and steel armour. As a marking, a wire piece is made out of a pure metal or metal alloy which is capable of partial transmutation by activation in the flux of neutrons of a nuclear reactor, into a radioactive isotope emitting a sufficiently penetrating gamma radiation to be detected by a Geiger counter. An activated fine gold wire is suggested glued in the form of a transverse marking to the cable elements inside the sheath. The activity of each marking at the time of laying is of the order of 1 millicurie. The sheathed and armoured cable was unwound and the elongation of the core under traction measured. (auth)

1251

ABSOLUTE PAIR PRODUCTION CROSS SECTION OF LEAD AT 2.76 MEV. S. Standil and R. D. Moore (Univ. of Manitoba, Winnipeg, Canada). Can. J. Phys. 34, 1126-33 (1956) Nov.

A value has been obtained for the absolute pair production cross section of Pb for the 2.76 Mev gamma rays of Na^{24}. A collimated beam of these gamma rays was made to fall on a specially constructed target and the positrons produced in the target were detected by counting two-quanta annihilation events by means of two scintillation spectrometers in coincidence. The strength of the Na^{24} source was measured by a coincidence counting technique and the counter detection efficiency for annihilation radiation was measured with a calibrated Na^{22} source. The effect of absorption of the 0.511 Mev annihilation radiation in the target was measured in a separate experiment. The value obtained for the cross section was 2.38 ± 0.62 barns. (auth)

1252

THE HALF-LIFE OF MERCURY-203. G. G. Eichholz and J. V. Krzyzewski. Can. J. Phys. 34, 1167-8(1956) Nov.

A determination of the half life of Hg^{203} was carried out by detecting radiation from a sealed Hg source by means of an argon-filled pressure ionization chamber and a vibrating-reed electrometer. The resultant value for the half life of Hg^{203} was 46.91 ± 0.14 days. (J.H.M.)

1253

RADIATIONS FROM TWO RADIOACTIVE ISOTOPES OF GOLD. V. R. Potnis (Barton Research Foundation of the Franklin Inst., Swarthmore, Penna.). Indian J. Phys. 30, 375-83(1956) Aug.

The angular correlation function of the 330 to 358 kev cascade in the decay of Au^{196} has been measured and is in accord with a 2-2-0 sequence of spins for the low lying states of Pt^{196}. The extent of anisotropy at 180° suggests the first emitted gamma transition to be a mixture of E2 in M1. The gamma radiation of the 185-day Au^{195} has been examined by scintillation counting methods and is found to consist of quanta at 31 kev and 99 kev in coincidence and the associated cross-over transition at 130 kev. (auth)

1254

A FAST COINCIDENCE SYSTEM FOR THE MEASUREMENT OF SHORT LIFETIMES. G. Jones and J. B. Warren (Univ. of British Columbia, Vancouver). J. Sci. Instr. 33, 429-31 (1956) Nov.

Details are given of a fast coincidence system comparable to that developed by Bell, Graham and Petch but employing the scheme of Neilson and James in which the time separa-

tion of associated events is converted to pulse amplitude and sorted on a conventional kicksorter. In this manner the whole coincidence resolution curve is obtained at one time while retaining an inherent time resolution of about 2×10^{-10} s. (auth)

1255

DESIGN AND PERFORMANCE OF A THIN MAGNETIC LENS β-RAY SPECTROMETER. T. D. Nainan, H. G. Deware, and Ambuj Mukerji (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 44A, 111-22 (1956) Sept.

Construction of a thin magnetic lens β-ray spectrometer is described. A baffle system which takes advantage of the ring focus has been designed on the basis of the calculations of electron trajectories limited to an angle of acceptance of 9–10.5 degrees. The results of the study of the β-ray spectra of Sr^{90} and Y^{90}, Pm^{147}, Tm^{170} are presented. (auth)

1256

LOW-LEVEL COUNTING METHODS FOR ISOTOPIC TRACERS. W. H. Johnston (Purdue Univ., Lafayette, Ind.). Science 124, 801-7(1956) Oct. 26.

1257

METHOD FOR PREDICTING AMOUNT OF STRONTIUM-89 IN MARINE FISHES BY EXTERNAL MONITORING. Howard Boroughs, Sidney J. Townsley, and Robert W. Hiatt (Univ. of Hawaii, Honolulu). Science 124, 1027-8(1956) Nov. 23.

Refer also to abstract 896.

MESONS

1258

OBSERVATIONS OF FORMATION AND DECAY OF UNSTABLE PARTICLES IN THE EMULSION CHAMBER. V. V. Alpers, I. I. Gurevich, and L. V. Surkova. Doklady Akad. Nauk S.S.S.R. 108, 421-2(1956) May 21. (In Russian)

V. V. Alpers et. al. (Doklady Akad. Nauk S.S.S.R. 105, 236(1955)) reported the data obtained during investigations of the emulsion chamber exposed to cosmic radiation for 6 hr at 25 km elevation in Sept. 1954. Further works revealed two additional τ mesons and one Λ^0 particle. Both τ mesons were found by systematic examination of separate layers along the area of the chamber and identified by the characteristic decay scheme $\tau \rightarrow \pi^+ + \pi^+ + \pi^- + Q$. The energies of the particles were determined on Ilford G-5 emulsion with an accuracy ± 3.3%. Observations of the first case of τ- meson decay revealed a π^+ meson with characteristic μ-meson decay of $R_\mu = 595\,\mu$ range. The second π meson did not form any visible star on its path and could be identified as the π^- meson. The third after passing $R = 10500\,\mu$ escaped. Determination of the τ-meson charge was prevented by the various signs of π meson at rest. The energy from τ-meson decay was estimated as $Q = (71.3 \pm 3.7)$ Mev and the mass $M_\tau = (960.3 \pm 7.3)m_e$. The τ meson and all three π-meson traces lay on the same plane within 2° accuracy. Observations of τ-meson traces indicate that it was formed in a 13 + 3 n type star. None of the beams could be identified as K mesons or hyperons. In the second case, also, two π mesons stopped in the emulsion chamber and the third escaped after passing 8750 μ. The π mesons remaining in the emulsion chamber had characteristic $\pi \rightarrow \mu$-e decay, i.e. both mesons had a positive sign. Energy estimates for τ-decay was $Q = (71.9 \pm 3.4)$ Mev and mass $m_\tau = (960.5 \pm 6.7)m_e$. All three π mesons lay in the same plane within 2% error. Studies indidated that the τ meson had been formed outside of the chamber and passed 14000 μ in it. Energy produced by both τ-meson decays was smaller than the accepted mean value $Q = (75.0 \pm 0.2)$ Mev but agreed with it within limits of error. The Λ^0 particle was discovered in the emulsion between the point at which π mesons came to rest and the star formation point. The proton and π-meson traces formed during Λ^0-particle decay: $\Lambda^0 \rightarrow p + \pi^- + Q$, lay completely within the limits of the emulsion chamber. The π^- meson captured by the nucleus at the rest point produced a tri-pronged star. The estimated energy of the decay was $Q = (37.2 \pm 1.2)$ Mev and mass $m_{\Lambda^0} = (2182 \pm 2.4)\,m_e$ and agree well with accepted mean values. (R.V.J.)

1259

DECAY CHARACTERISTICS AND MASSES OF POSITIVE K MESONS PRODUCED BY THE BEVATRON. R. W. Birge, D. H. Perkins, J. R. Peterson, D. H. Stork, and M. N. Whitehead (Univ. of California, Berkeley). Nuovo cimento (10) 4, 834-55(1956) Oct.

A large emulsion stack exposed to the positive K beam at the Berkeley 6 Gev Bevatron has been used to measure the mass of the K particles and their abundances. The masses for the decay modes $K_{\mu 2}$, $K_{\pi 2}$ and τ were obtained by measurement of the mean range of the secondaries. In addition, masses for all modes compared to the proton mass were measured by the range-momentum method. The abundances were determined by following and blob-counting secondaries. (auth)

1260

EVIDENCE FOR DIRECT EMISSION OF A PAIR OF γ-RAYS FROM THE POINT OF DECAY OF A K-MESON. M. S. Sinha and N. C. Das (Bose Institute, Calcutta). Phil. Mag. (8) 1, 785-7(1956) Aug.

A K_{μ_3} decay was found on a cloud chamber picture. The decay scheme $K_{\mu_3} \rightarrow \mu + \gamma + \gamma$ is suggested, and a mass of ~1462 m_e for the K meson is reported. (F.S.)

1261

GAMMA RAYS FROM STRANGE PARTICLES. Stuart L. Ridgway, David Berley, and George B. Collins (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 513-17(1956) Oct. 15.

Strange-particle production by protons in the Cosmotron range of energies was studied by observing gamma rays resulting from the decay of these particles at distances a few centimeters from the bombarded target. A laboratory energy threshold of 1.1 ± 0.1 Bev was measured for protons on a copper target, consistent with the hypothesis of associated production. A free-particle threshold is estimated. The production below threshold, at 1.0 Bev, is less than 10^{-2} of the 2.9-Bev production. The mean survival distance for particles produced at 1.7 Bev is 3.8 cm. Upon analysis this yields a lifetime which matches the one known for the θ^0 and suggests $\theta^0 \rightarrow 2\pi^0$. Unless the Λ^0 is produced with a strongly ($\cos^2\theta$) peaked forward and backward angular distribution, it cannot be the dominant source of the gamma rays. Under the assumption that these particles are hyperons or heavy mesons, the total cross section, of that component which decays via π^0 mesons, is 0.1 mb per carbon nucleus. (auth)

1262

A STUDY OF POSITIVE PION PRODUCTION IN p-p COLLISIONS AT 383 MEV. Margaret H. Alston, A. V. Crewe, W. H. Evans, and G. von Gierke (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A69, 691-704(1956) Sept.

An 18-in. diffusion cloud chamber filled with 28 atmospheres of H and in a magnetic field of 11,200 gauss is used to investigate the production of π^+mesons in p-p collisions at 383 Mev. The energy resolution is of the order of 2 Mev and the spectrum obtained can be divided into mesons from

the 'bound' and 'unbound' reactions. The angular distributions found are

$\frac{d\sigma}{d\omega}$(bound)$\propto(0.19 \pm 0.06) + \cos^2\theta'$ and $\frac{d\sigma}{d\omega}$(unbound)$\propto(0.21 \pm 0.07) + \cos^2\theta'$.

The branching ratio σ (unbound)/σ (total) = (47 ± 8)%. The shape of the unbound spectrum is not in agreement with that predicted by the phenomenological theory but this spectrum and also the high experimental branching ratio can be explained by the inclusion of a term $\sigma_{10}''(P_p) \cong 1.2\eta_{max}^{\ 8}$ in the theory. (auth)

METEOROLOGY

1263 NYO-4708

New York Operations Office. Health and Safety Lab., AEC.

EXPERIMENTAL COLLECTION EFFICIENCY OF A STRATOSPHERIC AIR SAMPLER. Peter Loysen, Alfred J. Breslin, and Hugo J. DiGiovanni. June 1956. 28p. $4.80 (ph OTS); $2.70(mf OTS).

The Health and Safety Laboratory built an electrostatic precipitator for stratospheric air sampling. The instrument has been in use over a period of two years. This report describes the sampler and an experimental study of its dust collection efficiency. The tests were conducted in a low pressure, walk-in chamber. Efficiency values were based on the relative quantities of aerosol collected by the sampler and on a following filter. The test medium was an ammonium chloride aerosol with a count median of 0.2 microns and a standard deviation of 2.5. Initial runs at a simulated altitude of 90,000 feet indicated an average collection efficiency of 27.1%. The high voltage supply was then modified to increase the precipitator corona current. Further tests following the modification indicated an average efficiency of 73.7%. Data are presented showing the sampler's voltage-current characteristics at several simulated altitudes. These will be used to redesign the power supply to achieve optimum performance. (auth)

1264

OBSERVATIONS OF UNUSUAL RADIOACTIVITY IN PRECIPITATIONS WHICH FELL IN BEBRECEN BETWEEN APRIL 22—DECEMBER 31, 1952. Szalay Sándor and Berényi Dénes. Budapest, Magyar Todomanyos Akademia, 1955. 13p. (In Hungarian)

It is suggested that radioactive fall-out may be useful for the meteorological study of the movement of air masses, if an international organization records fission fragment concentration after atomic test explosions. (tr-auth)

NEUTRONS

1265 KAPL-1597

Knolls Atomic Power Lab.,Schenectady, N. Y.

THE SCATTERING OF SLOW NEUTRONS BY HYDROGENOUS MODERATORS. T. J. Krieger and M. S. Nelkin. Aug. 1, 1956. 40p. Contract W-31-109-Eng-52. $0.30 (OTS).

An understanding of neutron thermalization and slow neutron transport in water-moderated reactors can be achieved only on the basis of a satisfactory theory of slow neutron scattering in hydrogenous materials. As a first step in the development of such a theory, it is reasonable to consider slow neutron scattering by free molecules. Liquid state effects will be reserved for future investigation, should these prove to play an important part in a complete theory. Although the theory of slow neutron scattering by polyatomic gases has been worked out recently in complete generality, the results are not readily adapted to neutron spectrum and transport calculations. This report presents workable approximate methods for describing the scattering of slow neutrons by polyatomic gases. Relatively simple analytic expressions for the various cross sections of interest are derived. The theory is used to calculate the total scattering cross section as a function of energy of the CH_4 molecule (with excellent agreement with experiment) and, also, of the H_2O molecule. To obtain agreement of the latter with the liquid H_2O total cross section, the values of certain molecular parameters must be changed, but in directions which are physically plausible. (auth)

1266 LA-1964

Los Alamos Scientific Lab., N. Mex.

SOME FOIL ABSORPTION CALCULATIONS. Glen A. Graves and William H. Roach. June 1955. 38p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00(mf OTS).

Calculations dealing with the transmission and absorption of neutron fluxes in single thin foils and in the individual members of a foil sandwich consisting of three foils of the same material placed in intimate contact are given. Foil absorption in collimated and isotropic fluxes of monoergic neutrons were studied as the results were needed for activation cross section calculations. Foil and sandwich absorption in isotropic flux of neutrons distributed in energy, including resonance cases to be used in predicting activations from known cross sections and theoretical flux distributions were calculated. (F.S.)

1267 MT-12

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ELEMENTARY APPROXIMATIONS IN THE THEORY OF NEUTRON DIFFUSION. P. R. Wallace and J. LeCaine. Aug. [20], 1943. 218p. (NRC-1480). $3.00(AECL).

This report presents in systematic form the solutions of problems of neutron diffusion in a single medium, both with and without multiplication, on the basis of elementary theory. The stationary state diffusion equation with capture is assumed for the diffusion of thermal neutrons, and the diffusion equation of the time-dependent type, without capture, for the diffusion of non-thermal neutrons. The stationary neutron densities are derived for various shapes of the medium and various source distributions. The problems are treated in the following sequence: determination of the density distribution of thermal neutrons due to sources of thermal neutrons non-thermal neutrons due to sources of fast neutrons, thermal neutrons due to sources of fast neutrons, without and with multiplication. The problem of multiplying systems under critical conditions in the absence of primary sources is treated in a final section. (auth)

1268 NDA-12-18

Nuclear Development Corp. of America, White Plains, N. Y.

PENETRATION OF NEUTRONS FROM A POINT FISSION SOURCE THROUGH CARBON AND HYDROCARBONS. J. Certaine, H. Goldstein, M. Kalos and P. S. Mittelman. June 30, 1956. 11p. For Oak Ridge National Lab. Contract [W-7405-eng-26], Subcontract 394. $3.30(ph OTS); $2.40(mf OTS).

Moment calculations have been performed to study the penetration of fission spectrum neutrons through carbon and hydrocarbons. For pure carbon, the neutron spectrum as a function of penetration depth and the "age" to 1.44 ev have been determined. For hydrocarbons having the formulae CH, $CH_{1.9}$, $CH_{2.0}$, and $CH_{2.1}$ the fast neutron dose has been determined as a function of penetration depth and an effective removal cross section of carbon has been evaluated. (auth)

1269 WAPD-PM-45

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. DISTRIBUTION OF NEUTRONS AT THERMAL ENERGIES. DESCRIPTION OF DONATE CODE. Harvey Amster and Roland Suarez. May 1956. 27p. $4.80(ph OTS); $2.70 (mf OTS).

A solution of the problem of the energy distribution of neutrons in equilibrium with an infinite medium undergoing thermal motion, alloying arbitrarily varying cross sections and including the case in which neutrons may be absorbed by elements other than H, provided their atoms are heavy or scarce enough not to influence the neutron energy distribution by non-absorbing collisions is analyzed. (F.S.)

1270 WAPD-TM-4

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. MULTIGROUP FOURIER TRANSFORM CALCULATION—DESCRIPTION OF MUFT-III CODE. R. L. Hellens, R. W. Long, and B. H. Mount. July 1956. 45p. Contract AT-11-1-GEN-14. $0.40(OTS).

A description is given of a code for the IBM-650 which computes the energy distribution of neutrons having a given Fourier mode in an infinite medium. Four approximations are provided with the inclusion of isotropic inelastic scattering, resonance capture, and fast fission. The output includes flux, current, and slowing density spectra and computes the fast constants for a variety of few group schemes. (auth)

1271

MAGNETIC MOMENT OF THE NEUTRON. V. W. Cohen and N. R. Corngold (Brookhaven National Lab., Upton, N. Y.) and N. F. Ramsey (Harvard Univ., Cambridge, Mass.). Phys. Rev. 104, 283-91(1956) Oct. 15.

An experiment has been performed to measure the magnetic moment of the neutron to a greater precision than has heretofore been obtained. The method is somewhat similar to that of atomic-beam magnetic resonance using separated oscillating fields. A beam of slow neutrons is polarized by reflection from a magnetized cobalt mirror and then reflected again from a similar mirror used as an analyzer. Between the two mirrors the neutrons pass through a region of uniform magnetic field where they may become depolarized by a resonant rf magnetic field. This results in a drop in intensity of neutrons reflected from the second mirror. The resonance frequency for depolarization is compared with the proton moment resonance frequency in the same transition region. In order to achieve high resolution of the neutron resonance, the path length of the neutrons in the uniform magnetic field was 110 cm. The measured ratio of resonant frequencies $\nu_n/\nu_p = 0.685057 \pm 0.000017$. This corresponds to a value of $\mu_n = -1.913148 \pm 0.000066$ nm. (auth)

Refer also to abstract 1233.

NUCLEAR PHYSICS

1272 AECU-3194

Kansas State Coll., Manhattan. PRECISION BETA-RAY SPECTROSCOPY. Termination Report. C. M. Fowler. Apr. 17, 1956. 21p. Contract AT(11-1)-187.

Detailed information on the radiations associated with several even-even isotopes has been obtained. In some instances enough information has been gathered to allow construction of skeleton energy level diagrams for the isotopes. Activities studied were obtained from pile irradiation of pure odd-even natural isotopes and included Dy^{160}, W^{182}, Sm^{152}, Gd^{152} and Gd^{154}. Details of the work done on and results obtained for these isotopes are reported. Some analytic and experimental studies were carried out on the application of tilting beta-ray spectrograph sources for improvement of resolution. The uses and limitation of this technique are discussed. (auth)

1273 CU-147

Columbia Univ., New York. Nuclear Physics Labs. PROGRESS REPORT 1955 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 93p. Contract AT-30-1-GEN-72. $15.30(ph OTS); $5.40(mf OTS).

The 16-channel time analyzer was replaced by a system containing 128 intervals with interval widths of 2, 1, and $\frac{1}{2}$ μsec available. A new γ detection system and collimating system with a flight path in He are in operation. Data on Ag and Ta with 1 and $\frac{1}{2}$ μsec interval widths were obtained. Simultaneous neutron transmission and fission cross section data for U^{235} were reported. The low-energy range of the crystal neutron spectrometer was extended to 11.5 A by the use of a focused mica crystal. Investigations on gold, fused quartz and various hydrogen containing compounds, and paramagetic scattering were continued. Measurements of the variation of the neutron transmission of liquid Bi with energy were completed and the results interpreted. Fission detectors for the study of U^{233} and Pu^{239} were investigated. The program to convert the 36-in. cyclotron to proton acceleration was continued. The Van de Graaff accelerator acceptance tests were completed and installation at Columbia begun. Additional equipment, a current integrator, a magnetic lens pair spectrometer, focusing lens system, target chambers, and a vacuum evaporator, were designed. Work was started on the virtual excited states of the mass 4 isotopes. The scattering of neutrons by paramagnetic targets is being calculated. Development work on a 2000-channel time analyzer capable of resolving the time of flight of neutrons to within a tenth of a μsec was started. Several 40-Mc binary scalers, a slow scaler, a non-blocking linear amplifier with a rise time of 0.03 μsec and a pulse time of flight converter to be used with a conventional multichannel pulse height analyzer for half-life measurements were designed and constructed. Development was completed on a fast rise double pulse generator with variable pulse reparation and independent control pulse amplitude and width. A slow-neutron monitor fission chamber for applications requiring long term stability was developed and an automatic counting system for selecting and taking background counts at any time was constructed. Activities of light particle investigations include energy level and decay scheme investigations; β spectrum and decay scheme of short-lived radioactive gases; positronium; formation inner bremsstrahling of A^{37}, and angular correlation experiments. More than 170 events in which the pion interacts to produce unstable particles were recorded in a cloud chamber. The cloud chamber is now able to utilize the external proton beam of the Brookhaven cosmotron in a search for long lived neutral particles. (For preceding period see CU-146.) (auth)

1274 CU-149

Columbia Univ., New York. Nuclear Physics Labs. PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH 1956 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 33p. Contract AT-30-1-GEN-72. $6.30(ph OTS); $3.00(mf OTS).

Modifications to the Nevis neutron velocity selector are described. Several methods are proposed for the determination of the absolute fission cross section of U^{235}. Progress in the installation of the Van de Graaff accelerator is reviewed. A study was made of the reaction

$N^{15}(p,\alpha\gamma)C^{12}$ in order to determine the excited states of O^{16}. Construction of a 3-crystal pair spectrometer was completed, and the spectrometer was tested. Progress in instrument development is reviewed. Block diagrams are shown for regulated magnet supplies. The operation of the automatic controller for the Van de Graaff high voltage regulator is described. Energies of the 8 γ lines from Br^{82} are listed. A sensitive ultraviolet spectrometer was constructed to study the light emitted by gases in which high-energy charged particles lose energy. Diagrams of the spectrometer are included. Data are given on Po alphas stopped in A, Xe, and He. (For preceding period see CU-147.) (B.J.H.)

1275 HW-43441

Hanford Atomic Products Operation, Richland, Wash.
PHYSICS RESEARCH QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1956. May 31, 1956. 69p. Contract W-31-109-Eng-52. $0.45(OTS).

The measurement of the multiplication factor of a lattice in the Lattice Testing Reactor is described and results given. Measurements are reported of the "favorableness" factors for this reactor. An experiment is described to measure that enrichment of uranium which will just permit unit multiplication in a water-U system. Buckling measurements are reported for graphite-enriched U lattices and for natural U lattices employing cluster-type rods. An exponential experiment to measure temperature coefficients of reactivity is described. Calculational results are given on the variation of lattice buckling with enrichment, on the thermal neutron flux in a cell and on the effect of graphite density on buckling. In theoretical reactor physics, a variational principle for multiple scattering is formulated, a new method for estimating fast leakage from bare reactors is outlined, and the spherical harmonic components of the flux in a void are computed. Experimental results showing that ν for Pu^{239} does not vary in the thermal region are quoted. A nuclear safety problem involving the interaction of an array of vessels is described. Finally, two instruments, a new type of pulse height analyzer and an automatic scanner and sample changer are described. (For preceding period see HW-42182.) (auth)

1276 IDO-16297

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MTR TECHNICAL BRANCH QUARTERLY REPORT [FOR] SECOND QUARTER, 1956. W. P. Conner, ed. Aug. 16, 1956. 119p. Contract AT(10-1)-205. $0.70(OTS).

The progressive surveillance of the effect of fast neutron flux upon the MTR core materials continues to show no evidence of structural weakness. Information is now available regarding the change in physical properties up to fast (greater than 100 ev) neutron exposures of 2.6×10^{22} nvt. Tensile strength, yield strength for 0.2 percent offset, and hardness of 347-stainless steel, 2S-aluminum and QMV beryllium are now changing only very slowly and appear to be reaching saturation values. Preliminary hydraulic testing of MTR fuel assemblies indicate that local flow velocities may drop about 10 percent below the over-all average velocity. The location of the lowest coolant flow is at the edge of the channels adjacent to the side plates, particularly in the outer channels. Technical support to the Engineering Test Reactor is becoming a significant part of the work load. A thorough examination of the quality of fabrication of a dummy fuel assembly has been carried out. Corrosion tests on the proposed boron–aluminum cladding metal indicate that this alloy is somewhat inferior to 2S aluminum. More definitive tests are required to establish its complete suitability. A nondestructive procedure for assaying the boron and U^{235} content in an ETR fuel assembly is being evaluated. A chemical procedure for nitrate ion has been developed to monitor the radiation produced nitrate ion concentration which analysis has been unnecessary in the MTR. In reactor physics, the major effort has been placed on the calculations related to the SPERT III reactor. The IBM 650 Computer has made it feasible to extend the earlier two group reactor calculations to three groups and to correct the thermal utilization as required by the flux depression in the fuel elements. The data obtained so far are presented for both the stainless steel and zirconium clad fuel plates. In the second sizeable problem, it has been predicted that about 40 grams additional U^{235} will be required in an MTR fuel assembly, should the present enrichment be reduced to 20 percent, in order to obtain an equivalent excess reactivity. In nuclear physics, the decay scheme of 2.7 hour Sr^{92} has been worked out after an examination of the beta and gamma spectra making use of coincidence counting. The current major effort in the cross sections program is the measurement of the fission cross section of U^{233} in both the crystal spectrometer and fast chopper energy regions. In this report the total cross sections of cadmium, tellurium, and gadolinium are presented. The cross sections of carbon, lithium, silicon, sulfur, and magnesium have been found to be constant up to 10 kev. (For preceding period see IDO-16291.) (auth)

1277 NP-6142

Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period July–September 1956. Oct. 1, 1956. 32p.

Neutrons in the energy range 3.8 to 8.1 Mev were used to determine the total neutron cross sections of Be, C, F, and Ge. Differential cross sections have been measured as a function of bombarding energy. Results obtained for the ground-state and first-excited-state proton groups from the $Be^9(He^3,p)B^{11}$ reaction showed no resonance. Measurements were made for the ground-state groups for $C^{13}(He^3,p)N^{15}$ and $C^{13}(He^3,\alpha)C^{12}$. The mass and half-life of B^8 were determined. Differential cross sections for the $C^{12}(He^3,p)N^{14}$ reaction as a function of energy were measured for six angles. In order to find energy levels in Ni^{59} the reaction $Co^{59}(p,n)Ni^{59}$ was investigated using a neutron threshold technique. The equatorial flux of primary He nuclei was measured in a stack of stripped emulsions. Two events were found which support the hypothesis of the existence of a long-lived neutral K meson in an emulsion stack exposed to the 90° K^- beam of the Berkeley Bevatron. The energy and angular distributions of photoneutrons from leach were determined by the use of recoil protons in nuclear emulsions. Equipment was assembled and used to detect directly the photoneutrons emanating from Fe, Ge, Rb, and Hf. Exact and approximate treatments of the one-dimensional blast wave were considered. A Mach-Zehnder interferometer was used to study the heat transfer between several types of pulse-heated surfaces and water. The highest temperature gradient that can be resolved in water is much less than that for air and the alignment procedure was found to be more difficult. (F.S.)

1278 PR-P-30

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
PHYSICS DIVISION PROGRESS REPORT [FOR] APRIL 1, TO JUNE 30, 1956. 81p. (AECL-343).

Proton energy and target thickness effects on neutron yield and mean multiplicity in (p,n) reactions were determined for Sn, W, Pb, and U at proton energies of 300, 450, and 750 Mev. The mechanisms of element formation in types I and II supernova explosions are considered. The

presence or absence of exponential light tails is interpreted as an indication of the formation mechanism. The results of decay scheme studies on Tb^{160}, Nd^{147}, Pm^{147}, and Gd^{156}; proton reaction analyses on Mg^{24}, Mg^{26}, Al^{27}, and C^{14}; and cross section measurements for $Li^6(n,\gamma)Li^7$ and $Ga(n,\gamma)$ are reported. Progress in the study of the low-temperature properties of Ce is reviewed. Instrument and computer developments are reported. (For preceding period see PR-P-29.) (D.E.B.)

1279 AEC-tr-2337

RADIOCHEMICAL STUDY OF THE FISSION PRODUCTS OF BISMUTH, THORIUM, AND URANIUM UPON BOMBARDMENT WITH 480 MEV PROTONS. A. P. Vinogradov, I. P. Alimarin, V. I. Baranov, A. K. Lavrukhina, T. V. Baranova, F. I. Pavlotskaya, A. A. Bragina, and Yu [I]. V. Yakovlev. p.97-119 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p.

Radiochemical investigations of the products of bombardment of U, Th, and Bi with 480-Mev protons have revealed similar nuclear processes. There has been observed the production of light elements, fission products, and spallation products in all cases. The detailed investigation of the fission of U, Th, and Bi with 480-Mev protons has shown that the yield mass curve is symmetrical with one wide maximum. The fission of these nuclei with fast protons does not produce long radioactive chains. There is observed the formation of a significant number of fragments emitting positrons and undergoing K-capture. All this points toward the emission of neutrons upon fission. It has been established that the characteristics of the fission of Th and U with fast particles of different energy are similar. This indicates that these characteristics will be present in the fission of other heavy elements also. The cross section for the fission of U and Th with 480-Mev protons is of the order of geometrical. The cross section for the fission of Bi is significantly lower (7×10^{-26} cm^2). On the average, 2 protons and 16 neutrons are emitted before fission of Bi, indicating the emission character of this process. (auth)

1280

SAMPLE SPINNING AND FIELD MODULATION EFFECTS IN NUCLEAR MAGNETIC RESONANCE. G. A. Williams and H. S. Gutowsky (Univ. of Illinois, Urbana). Phys. Rev. 104, 278-83(1956) Oct. 15.

Sideband resonances have been observed in high-resolution nuclear magnetic resonance experiments in which a cylindrical sample is rotated in a magnetic field with a linear gradient. It is shown that these sidebands arise in a manner similar to the sidebands observed when the magnetic field is modulated by an external source. The general question of time dependent local magnetic fields is considered and the effects of coherent fluctuations are compared with those of random fluctuations for several simple models. (auth)

1281

RADIATION DAMPING AND RESONANCE SHAPES IN HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE. C. R. Bruce, R. E. Norberg, and G. E. Peak (Washington Univ., St. Louis, Mo.). Phys. Rev. 104, 419-20(1956) Oct. 15.

An analysis of a nuclear spin-resonant circuit system shows that the electric circuit parameters rather than the nuclear spin relaxation times may determine resonance widths, maximum signal, and integrated intensities in high-resolution continuous-wave nuclear magnetic resonance. (auth)

1282

NUCLEAR SURFACE EFFECTS. D. P. Hale and R. D. Present (Univ. of Tennessee, Knoxville). Phys. Rev. 104, 448(1956) Oct. 15.

The nuclear surface energy and surface thickness have been calculated from a model in which the assumed volume energy density is a simple empirical function of the particle density and the particle density is a simple empirical function of position. Weizsäcker's inhomogeneity correction has been used in unmodified form. For various combinations of empirical energy densities (leading to reasonable compressibilities) with empirical particle densities, the calculated surface energies were found to agree within 15% with the surface energy term of the semiempirical mass formula. The calculated surface thicknesses exceed by 20% to 60% the surface thickness of the proton distribution inferred from electron scattering experiments. (auth)

1283

MESONIC DECAY OF A LITHIUM HYPERFRAGMENT. O. Skjeggestad and S. O. Sörensen (Univ. of Oslo, Blindern, Norway). Phys. Rev. 104, 511-12(1956) Oct. 15.

The mesonic decay of a nuclear fragment in a photographic emulsion is described. The event is most simply interpreted as the disintegration of a Li^{7*} hyperfragment according to the scheme $Li^{7*} \rightarrow He^4 + H^2 + H^1 + \pi^-$. The binding energy of the Λ^0 particle in the fragment is 4.4 ± 1.0 Mev. (auth)

1284

ANGULAR DISTRIBUTION IN ELECTRON-PHOTON SHOWERS WITHOUT THE LANDAU APPROXIMATION. B. A. Chartres and H. Messel (Univ. of Sydney, Australia). Phys. Rev. 104, 517-25(1956) Oct. 15. (cf. NSA 9-7425).

The track-length angular distribution of electrons in an electron-photon cascade is calculated without the use of the Landau approximation which was invariably used in all previous work. The Tamm-Belenky model of the cascade is used. The results are presented in the form of a series, the first term of which is of the same form as the result yielded by the Landau approximation but with a modified value of the parameter E_1. It is shown that the use of the Landau approximation introduces large errors not only for large values of the argument but for small values as well. The bearing of this result on previous theoretical work on the lateral distribution function is discussed. (auth)

1285

π^-−p INTERACTIONS IN THE 1.0-BEV REGION. W. D. Walker, F. Hushfar, and W. D. Shephard (Univ. of Wisconsin, Madison). Phys. Rev. 104, 526-35(1956) Oct. 15.

Examinations were made of 450 π^-−p collisions of energy about 1 Bev. About one-third of these have been found in emulsion and the rest in the Brookhaven hydrogen diffusion chamber. About one-half of the total cross section at this energy comes from elastic processes. The differential elastic cross section is characterized by a sharp peak in the forward direction and considerable bump in the backward hemisphere. It is demonstrated that a considerable portion of the elastic cross section is produced by refraction rather than diffraction. The target radius of the nucleon at this energy seems to be $\geq 1.1 \times 10^{-13}$ cm which is essentially the same result that has been found at 1.4 to 1.5 Bev. The inelastic processes seem to exhibit somewhat different features at this energy from those at 1.5 Bev. The angular distributions of all products are almost isotropic. The nucleons seem to slightly prefer the backward hemisphere but not to nearly the same degree as found at 1.5 Bev. The π^- seem to lose most of their energy in the inelastic processes and this too is somewhat different from the 1.5-Bev results. The momentum change spectrum

for the nucleons is nearly the same at 1.0 and 1.5 Bev. These results are discussed in terms of the Dyson-Takeda model which introduces a pion-pion interaction. Possible isobar formation is also discussed. (auth)

1286

SURVEY OF THE THEORY OF ANTIPARTICLES, CHARGED ELEMENTARY PARTICLES, AND THE PROPERTIES OF HEAVY NEUTRAL MESONS. Ya. B. Zel'dovich. Uspekhi Fiz. Nauk 59, 377-98(1956) July. (In Russian)

A review is given of the particle-antiparticle theory. The chapters survey the nuclear and neutron charge, the mass-energy equivalence law, strange particles, and properties of θ mesons. (R.V.J.)

NUCLEAR PROPERTIES

1287 IDO-16300

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE NEUTRON TOTAL CROSS SECTIONS OF MAGNESIUM, SILICON, AND SULFUR. R. M. Brugger and R. G. Fluharty. Aug. 28, 1956. 6p. Contract AT(10-1)-205. $0.15(OTS).

The total neutron cross sections of Mg, Si, and S have been measured from 250 ev to 10 kev. In this region, the cross sections do not vary significantly with energy and have the following average values: Mg, (3.60 ± 0.20 barns); Si, (2.43 ± 0.20 barns); S, (1.17 ± 0.10 barns). The previously observed resonance in Mg at 18 kev was also observed. (auth)

1288 LA-1916

Los Alamos Scientific Lab., N. Mex.

FISSION NEUTRON SPECTRUM OF U^{235} FROM 0.2 TO 3 MEV. Lawrence Cranberg and Norris G. Nereson. May 1955. 42p. Contract [W-7405-eng-36].

The neutron spectrum associated with the fission of U^{235} induced by slow neutrons has been measured from 0.175 to 3.0 Mev. The experiment was carried out by measuring the flight time of the fission neutrons from their U^{235} source to the detector. Emphasis was placed on setting up a clean experimental arrangement and on obtaining a reliable background measurement. Background percentages ranged from 18% at the lowest energy to ~2% at the highest energy. The energy resolution of the measurements varied from about 13% at 0.2 Mev to 40% at 2 Mev; the corresponding statistical errors at these energies were 9% and 3%. Other errors combined with the above values to give an over-all accuracy of approximately ±10% over the low-energy region. Within the above error limits, the experimental points confirm the relation, $N(E) = k\sqrt{E}\, e^{-0.775E}$, which is in current use for expressing the fission spectrum. (auth)

1289 NAA-SR-1659

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ELECTRONIC PROPERTIES OF THORIUM, URANIUM AND PLUTONIUM. I. ATOMIC ENERGY LEVELS. Guy W. Lehman. Nov. 15, 1956. 19p. Contract AT-11-1-GEN-8. $0.20(OTS).

The low-lying one-electron term values and atomic wave functions of Th, U, and Pu have been computed using the Mayer potential function. These results show that the 5f, 6d, and 7s states will form the low-lying valence states in the actinide atoms in qualitative agreement with the spectroscopic data. The term values computed from the Mayer potential are compared with those computed by Latter. Latter's calculations show that the term values are extremely sensitive to small changes in the form of the potential energy function. The effect of spin-orbit interaction is examined and the 5f and 6d levels are found to be split by about 0.7 and 0.4 ev respectively. This splitting is not sensitive to the form of potential used. (auth)

1290

THE NUCLEAR MAGNETIC RESONANCE SPECTRUM OF Na^{23} IN $NaH_2PO_4-2H_2O$. F. Holuj and H. E. Petch (McMaster Univ., Hamilton, Ont., Canada). Can. J. Phys. 34, 1169-70(1956) Nov.

An investigation was made of the Na^{23} nuclear quadrupole interaction in a single crystal of $NaH_2PO_4 \cdot 2H_2O$ at room temperature. (J.H.M.)

1291

NEUTRON CROSS-SECTION OF Re^{188} AND HALF-LIFE OF Re^{189}. R. R. Smith (Phillips Petroleum Co., Idaho Falls, Idaho). J. Inorg. and Nuclear Chem. 3, 157-9(1956) Oct.

The irradiation of a Re sample for 16 days in an average thermal neutron flux of 1.80×10^{14} n/cm^2 sec failed to produce observable quantities of second-order Re activities. From an upper limit estimated for the activity of all residual long-lived species it is concluded either that the absorption cross-section of Re^{188} is unusually small or that the half-life commonly assumed for Re^{189} is in error. (auth)

1292

HALF-LIVES OF Ce^{144}, Co^{58}, Cr^{51}, Fe^{55}, Mn^{54}, Pm^{147}, Ru^{106}, AND Sc^{46}. R. P. Schuman, M. E. Jones, and A. C. Mewherter (Knolls Atomic Power Lab., Schnectady, N. Y.). J. Inorg. and Nuclear Chem. 3, 160-3(1956) Oct.

Half-lives have been obtained for a number of radionuclides by following the decay of purified samples over periods of time as long as six years. The data were treated by the method of least squares. The half-lives are 284.5 ± 1.0 days for Ce^{144}, 71.3 ± 0.2 days for Co^{58}, 27.8 ± 0.1 days for Cr^{51}, 2.60 ± 0.02 years for Fe^{55}, 278 ± 5 days for Mn^{54}, 2.66 ± 0.02 years for Pm^{147}, 366.6 ± 0.9 days for Ru^{106}, and 84.1 ± 0.3 days for Sc^{46}. (auth)

1293

TOWNSEND IONIZATION COEFFICIENT FOR HYDROGEN AND DEUTERIUM. D. J. Rose (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 104, 273-7(1956) Oct. 15.

The Townsend ionization coefficient α/p_0 (cm × mm Hg at 0°C)$^{-1}$ for H and D has been measured as a function of E/p_0 (volts/cm × mm Hg at 0°C) over an extended range. The results for H_2 have been compared critically with those of previous workers. They agree well with several recent redeterminations over limited ranges of E/p_0, but not with several earlier extensive investigations. The composite results for H_2 ($15 < E/p_0 < 1000$), and present data for D_2 ($18 < E/p_0 < 600$), are presented in graphical and tabular form. The difference between the two coefficients is discussed in terms of the molecular properties of the two gases. It appears that the difference in energy loss by recoil on electron impact is insufficient to explain the observed effect. (auth)

1294

AUGER EJECTION OF ELECTRONS FROM TUNGSTEN BY NOBLE GAS IONS. Homer D. Hagstrum (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 104, 317-18(1956) Oct. 15.

Previously published data on Auger ejection from tungsten include the effect of a two percent admixture of metastable ions in the ion beam for A, Kr, and Xe. Data on yield and kinetic energy distribution of electrons ejected by the normal singly-charged ion only are presented in this paper. (auth)

1295

MEAN LIFE OF THE $^3P_2$ METASTABLE ARGON LEVEL. A. H. Futch and F. A. Grant (Univ. of Maryland, College Park). Phys. Rev. 104, 356-61(1956) Oct. 15.

Using a previously described light absorption technique,

the mean life of the metastable $^3P_2$ level of argon has been measured in pure argon as a function of pressure at 77°K and 300°K, and in mixtures of neon and argon at 300°K. The coefficient of diffusion of metastable argon atoms in the parent gas falls much more rapidly with decreasing temperature than the $T^{\frac{1}{2}}$ dependence predicted using the hard-sphere model. The cross section for the quenching of metastable atoms by two-body collisions with normal atoms changes slightly with temperature, in a manner inconsistent with the assumption of collision-induced transitions to the radiating $^3P_1$ level. As the temperature is reduced from 300 to 77°K, the frequency of quenching by three-body collisions increases from $13.5p^2$ to $440p^2$ sec^{-1} (mm of Hg)^2. At a given total pressure, the two-body quenching collision cross section is much reduced and the three-body quenching collisions disappear as the ratio of partial pressures of neon to argon is increased. (auth)

1296

ELASTIC SCATTERING OF PROTONS FROM Na^{23}. N. P. Baumann, F. W. Prosser, Jr., W. G. Read, and R. W. Krone (Univ. of Kansas, Lawrence). Phys. Rev. 104, 376-83(1956) Oct. 15.

The elastic scattering of protons from Na^{23} has been obtained over the proton energy range from 0.58 to 1.50 Mev at the angles of 90° and 157.5°. Additional readings were made at angles of 125° and 140° at resonances. Thin metallic sodium targets on thin nylon backings were used. Out of 31 known resonances for Mg^{24} in this energy region, 12 unambiguous assignments of spin and parity were made. With the energy given in Mev, these are E_p = 0.594 (3−); 0.725 (0−); 0.797 (1−); 0.815 (2+); 0.849 (4+); 0.877 (1+); 0.922 (2+); 1.022 (2−); 1.176 (1+); 1.258 (1+); 1.288 (1−); 1.398 (3+); and 1.460 (3−). Three tentative assignments were made for E_p = 1.206 (2−); 1.213 (3+); and 1.365 (0−). The excitation curve for alpha-particle emission to the ground state of Ne^{20} was obtained simultaneously to give a differential cross section for this reaction. Resonance states were found which agreed in spin and parity as well as energy with those found before only in the elastic scattering of alpha particles from Ne^{20}. (auth)

1297

NUCLEAR ALIGNMENT OF Co^{58}. David F. Griffing and J. C. Wheatley (Univ. of Illinois, Urbana). Phys. Rev. 104, 389-98(1956) Oct. 15.

By using a two-stage adiabatic demagnetization technique, Co^{58} nuclei were aligned in single crystals of (22.7% Cu 77.3% Zn) $K_2(SO_4)_2.6H_2O$ containing a trace of cobalt. Both the 0.805-Mev and 1.6-Mev gamma rays were measured at three angles as a function of the paramagnetic susceptibility. The 1.6-Mev gamma ray was determined to be quadrupole. A parameter λ related to the mixture of Fermi and Gamow-Teller interactions in the allowed beta decay was determined to be 0.11 ± 0.04 in the transition to the 0.805-Mev level in Fe^{58} and 0.45 ± 0.11 in the transition to the 1.6-Mev level. By using the 0.805-Mev counting rate as a thermometer, the paramagnetic susceptibility was determined as a function of the absolute temperature and fitted to the formula $\chi(T) = (c/T)F(T)_h f_0(1 + \Delta/T + \epsilon/T^2)$. The data indicate an antiferromagnetic interaction between copper ions, in disagreement with previous work. (auth)

1298

ANGULAR CORRELATION IN THE 2.86-0.72 MEV CASCADE IN B^{10}. S. M. Shaforth and S. S. Hanna (Johns Hopkins Univ., Baltimore). Phys. Rev. 104, 399-401(1956) Oct. 15.

The directional correlation in the 2.86−0.72-Mev cascade in B^{10} has been studied by utilizing the $Be^9(d,n)B^{10*}(\gamma)B^{10}$ reaction. At low bombarding energies and with thick targets the gamma-gamma correlation appears to be substantially independent of the preceding (d,n) reaction. With spins of 3 and 1 for the two low states of B^{10}, the observed correlation is consistent with the schemes: 2(93%D, 7%Q, 0 phase)1(Q)3; 2(Q)1(Q)3; 1(89%D, 11%Q, π phase)1(Q)3, or 1(11%D, 89%Q, π phase)1(Q)3. (auth)

1299

MAGNETIC MOMENT OF THE SECOND EXCITED STATE OF F^{19}. P. Lehmann, A. Leveque, and R. Pick (Centre d' Etudes Nucleaires de Saclay, GIF-sur-YVETTE, France). Phys. Rev. 104, 411-12(1956) Oct. 15.

The perturbation of the angular distribution of the 197-kev gamma rays following inelastic scattering of protons in F^{19} has been measured as a function of an external magnetic field and the magnetic moment of the 197-kev state has been extracted from these measurements. A value of + (3.70 ± 0.45) nuclear magnetons has been found. The lifetime of this state has been determined precisely: $\tau = (1.23 \pm 0.07) \times 10^{-7}$ sec. (auth)

1300

MEASUREMENT OF ENERGY LEVELS IN F^{19} AND O^{16}. G. L. Squires, C. K. Bockelman, and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 104, 413-15(1956) Oct. 15.

The broad-range magnetic spectrograph of the Massachusetts Institute of Technology High Voltage Laboratory has been used to study the proton groups from the reaction $F^{19}(p,p')F^{19*}$ and the alpha-particle groups from the reaction $F^{19}(p,\alpha)O^{16*}$. The incident protons had an energy of 7 Mev and were produced by the MIT-ONR Van de Graaff generator. The ground-state Q value for the $F^{19}(p,\alpha)O^{16}$ reaction was found to be 8.110 ± 0.010 Mev. Values of the energy levels of F^{19} and O^{16} are given up to 4.05 and 11.3 Mev, respectively. (auth)

1301

POLARIZATION OF 220-MEV PROTONS ELASTICALLY SCATTERED FROM CARBON. W. G. Chesnut, E. M. Hafner, and A. Roberts (Univ. of Rochester, N. Y.). Phys Rev. 104, 449-56(1956) Oct. 15.

Protons polarized to 89% have been scattered from C^{12} in the laboratory angular range from 4 to 40 degrees. Data were obtained on angular distributions and asymmetries in three closely spaced energy channels spanning the high-energy tail of the incident spectrum. In spite of the great width of this spectrum, it was possible to extrapolate the data so as to give fair separation of elastic from inelastic scattering. The elastic asymmetries exhibit clear evidence of a deep minimum at 27 degrees followed by a strong maximum at 35 degrees, in qualitative agreement with various predictions from L.S coupling in an optical model of the scattering. Possible reasons are given for the failure of the minimum to appear in the results of other experimenters. (auth)

1302

ENERGY LEVELS OF Be^9. C. K. Bockelman, A. Leveque, and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 104, 456-60(1956) Oct. 15.

Magnetic analysis of the alpha-particle groups from the deuteron bombardment of boron and of the proton bombardment of beryllium confirms previous work indicating the existence of levels in Be^9 at 2.43 and 3.04 Mev. The energy of the edge of a broad distribution at 1.664-Mev excitation is taken to indicate that it arises from a three-body reaction; the shape of the edge indicates the influence of the Be^8−n interaction. (auth)

1303

ATOMIC MASSES IN THE REGION FROM IRON TO ZINC. K. S. Quisenberry, T. T. Scolman, and A. O. Nier (Univ. of Minnesota, Minneapolis). Phys. Rev. 104, 461-70(1956) Oct. 15.

The large double-focusing mass spectrometer recently constructed at this laboratory has been used to measure the atomic masses of the stable isotopes of iron, cobalt, nickel, copper, and zinc. Except in the cases of nickel and copper, the new masses agree reasonably well with the results of previous investigations. The isotopic assignment of neutron capture γ rays in the above elements has been examined using the new data and several new (n,γ) reaction Q values result. Comparison between measured stable isotope mass differences and the mass differences calculated from nuclear disintegration energies shows no outstanding discrepancy in this region, assuming the new (n,γ) assignments to be correct. From nuclear energy data a complete mass table has been calculated for these five elements and the resulting masses used to investigate nucleon binding energies. The binding energy of the last proton or last neutron in the nucleus shows a reasonably consistent variation with mass. Pairing energies for the last neutron and last proton pairs have also been calculated wherever sufficient mass data exist. Only partial correlation seems possible between pairing energy and the angular momentum of the level occupied by the pair. (auth)

1304

DECAY SCHEME OF Re^{183} AND ROTATIONAL BANDS OF DAUGHTER NUCLEUS W^{183}. S. Thulin, J. O. Rasmussen, C. J. Gallagher, Jr., W. G. Smith, and J. M. Hollander (Univ. of California, Berkeley). Phys. Rev. 104, 471-4 (1956) Oct. 15.

The electron-capture decay of 70-day Re^{183} has been studied, principally by conversion electron spectroscopy at 0.1% resolution. All but one of the eighteen gamma transitions identified in the present study have been seen by others from beta decay of Ta^{183} to the same daughter nucleus W^{183}. The transition intensities of the present study suggest an assignment of $5/2+$ to Re^{183}. New information on M1-E2 mixing ratios for some of the gamma transitions is obtained. (auth)

1305

THEORY OF INELASTIC ELECTRON SCATTERING BY THE C^{12} NUCLEUS. R. A. Ferrell and W. M. Visscher (Univ. of Maryland, College Park). Phys. Rev. 104, 475-8 (1956) Oct. 15.

The recently measured elastic and inelastic electron scattering cross sections of C^{12} are utilized to test the shell model of light nuclei. Collective effects are important in the excitation of two of the excited states (7.68 and 4.42 Mev), and are acceptably accounted for by the independent-particle approach to collective oscillations recently proposed by the authors. The inelastic scattering data leading to the 9.61-Mev state are shown to identify it as probably 1^-. Some of the results of higher energy scattering experiments on C^{12} and O^{16} are predicted. (auth)

1306

FISSION CROSS SECTION OF U^{235} FROM 6 TO 2000 EV. M. L. Yeater, W. R. Mills, and E. R. Gaerttner (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 104, 479-80(1956) Oct. 15.

The fission cross section of U^{235} from 6 to 2000 ev has been measured with a large fission chamber in the KAPL neutron velocity selector. Improved resolution makes it possible to observe fluctuations in the previously unresolved range above 60 ev. (auth)

1307

NUCLEAR LEVELS IN Dy^{161}. J. M. Cork, M. K. Brice, L. C. Schmid, and R. G. Helmer (Univ. of Michigan, Ann Arbor). Phys. Rev. 104, 481-3(1956) Oct. 15.

A specimen of Gd^{160} enriched from its normal 21.9% up to 95.4% was irradiated in the Argonne heavy water pile. The Gd^{161} formed by neutron capture decays by beta and gamma emission with a half-life of 3.7 min to radioactive Tb^{161}. Spectrometric studies of this activity show it to decay with a half-life of 7.15 days emitting both beta and gamma rays many of which previously have not been evaluated. There appear to be seven gamma rays in Dy, all internally converted, whose energies are: 25.6, 27.7, 48.9, 57.3, 74.8, 78.3, and 106.2 kev. These energies fit into a scheme with nuclear levels at 25.6, 74.8, 103.9, and 132.0 kev. Coincidence data with the scintillation spectrometer support the proposed plan. The beta spectrum, studied with the double focusing spectrometer, appears to be complex, having three components whose energies are 531, 447, and 405 kev, with relative intensities of 68%, 22%, and 10%, and log ft of 6.7, 6.9, and 7.2, respectively. (auth)

1308

FLUCTUATIONS OF NUCLEAR REACTION WIDTHS. C. E. Porter (Brookhaven National Lab., Upton, N. Y.) and R. G. Thomas (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 104, 483-91(1956) Oct. 15.

The fluctuations of the neutron reduced widths from the resonance region of intermediate and heavy nuclei have been analyzed by a statistical procedure which is based on the method of maximum likelihood. It is found that a chi-squared distribution with one degree of freedom is quite consistent with the data while a chi-squared distribution with two degrees of freedom (an exponential distribution) is not. The former distribution corresponds to a Gaussian distribution for the reduced-width amplitude, and a plausibility argument is given for it which is based on the consideration of the matrix elements for neutron emission from the compound nucleus and of the central limit theorem of statistics. This argument also suggests that within the framework of the compound-nucleus theory all reduced-width amplitudes have Gaussian distributions, and that many of the distributions for the various channels may be independent. One consequence of the latter suggestion is that the total radiation width for a given spin state which is formed in neutron capture will be essentially constant, in agreement with some observations, because it is the sum of many partial radiation widths. The fluctuations of the provisional fission widths of U^{235} are best described by a chi-squared distribution with about $2\frac{1}{2}$ degrees of freedom, indicating that there are effectively only a few independently contributing fission channels. (auth)

1309

HYPERFINE STRUCTURE OF K^{39} IN THE 4 P STATE AND OF Cs^{133} IN THE 6 P STATE. P. Buck, I. I. Rabi, and B. Senitzky (Columbia Univ., N. Y.). Phys. Rev. 104, 553-4 (1956) Oct. 15.

The atomic-beam resonance method was used to investigate the hyperfine structure of the 4P excited state of K^{39} and the 6P excited state of Cs^{133}. The observed resonances are tabulated. (B.J.H.)

1310

NEUTRON CROSS SECTION OF XENON-135. Robert W. Deutsch (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 104, 555(1956) Oct. 15.

The analysis of data on the neutron cross section of Xe^{135} is discussed briefly. (B.J.H.)

NUCLEAR REACTORS

1311 AECU-3268

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

PHOTOELASTIC ANALYSIS OF STRESS IN REACTOR PRESSURE VESSEL STR CORE 4 PREFERRED HEAD. Research Report 100FF971-R1. R. C. Sampson and M. M. Leven. Jan. 6, 1956. 19p. For Westinghouse Electric

Corp. Bettis Plant. Contract AT-11-1-GEN-14, CG 20000, 25b25. $3.30(ph OTS); $2.40(mf OTS).

A model of the STR Core 4 preferred head having seventeen holes was tested by the "frozen stress" photoelastic model technique. The highest stresses due to internal pressure occur on the ligaments between holes at the top surface, where the maximum tensile stress was found to be a little more than nine times the value of the internal pressure exerted on the vessel. In general lower tensile stresses were found on the hole boundaries at the inner surface of the head. (auth)

1312 AECU-3358

Ionics, Inc., Cambridge, Mass.

PROGRESS REPORT [FOR] MAY 15, 1954 TO JUNE 15, 1954. Carolus M. Cobb. June 30, 1954. 7p. For Westinghouse Electric Corp. Atomic Power Div. Subcontract 57B-(04-701). $1.80(ph OTS); $1.80(mf OTS).

The performance of various resins for use in reactor cooling system demineralizers is reported. (D.E.B.)

1313 AERE-R/R-2051

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CRITICAL ASSEMBLIES OF AQUEOUS URANYL FLUORIDE SOLUTIONS. PART I. EXPERIMENTAL TECHNIQUES AND RESULTS. W. G. Clarke, C. C. Horton, and M. F. Smith. Sept. 20, 1956. 37p.

Critical masses of U^{235} and U^{233} in the form of UO_2F_2 in aqueous solution have been measured in cylindrical geometry for a range of concentrations $H/U_{fissile}$ 250 to 850. A cylinder radius of 15.24 cm was used with an effectively infinite radial water reflector. Where possible estimates were made of the critical masses for the system unreflected and also for the system reflected but with the Cd shut off sheath between the core and reflector. Flux measurements were made through the system in axial and radial directions at all concentrations. The effect of change of temperature on the system over the range 15 to 90°C was observed for all concentrations. An assembly for each isotope in a very concentrated solution $H/U^{235} = 60$, $H/U^{233} = 32$ was also made in a 6.35 cm radius cylinder but was not brought to criticality. (auth)

1314 ANL-5437

Argonne National Lab., Lemont, Ill.

UNIVAC PROGRAMS FOR THE SOLUTION OF ONE-DIMENSIONAL MULTIGROUP REACTOR EQUATIONS. M. K. Butler and J. M. Cook. [Oct. 1956]. 408p. Contract W-31-109-eng-38. $1.75(OTS).

Six UNIVAC programs are described in detail. The programs were designed to compute, by a finite difference method, the real and adjoint solutions of the multigroup diffusion equation system in cylindrical, spherical and slab geometry. Contingent upon the complexity of the problem, the machine computation time ranged from a few minutes to more than an hour, with a cumulative average of about 15 to 20 minutes. (auth)

1315 CF-53-10-107

Oak Ridge National Lab., Tenn.

FLOW TEST OF THE PROPOSED ISHR CORE. L. B. Lesem. Nov. 13, 1953. Decl. Sept. 13, 1956. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Pressure drops across the core and the vaned ell (approximately 2 velocity heads or 2.3 psi for the combination) are of reasonable magnitude for a practical reactor. Flow conditions appear to be stable and the resulting temperature should prove to be satisfactory. (auth)

1316 CF-55-6-194

North Carolina State College, Raleigh. School of Engineering.

PART II. PRELIMINARY INVESTIGATION OF THE FISSION PRODUCT RETENTION OF METAL AND CERMET COMPACTS. W. E. Moody, W. D. Whitehead, Jr., and W. W. Kriegel. June 1955. 13p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 565. $3.30 (ph OTS); $2.40(mf OTS).

Between 360 and 560°C, the compacts composed of 0.010 in. of U–Al alloy clad in 0.020 in. of Al lost approximately 0.01 to 2.0% of the volatile fission products. Between 900 and 1100°C, the elements composed of 0.010 in. of stainless steel–UO_2 clad in 0.010 in. of stainless steel allowed approximately 0.01 to 0.03% of volatile fission products to escape. A dark surface crust or film was observed on the stainless steel specimens. The Al_2O_3–Cr element with 0.020 in. cladding allowed approximately 0.04 to 1.5% of the volatile fission products to escape between 1000 and 1100°C. The 0.025 in. cladding of MgO–Ni allowed approximately 2.4 to 12% of the volatile fission products to escape between 1000 and 1100°C. (auth)

1317 CF-55-8-199

Oak Ridge School of Reactor Technology, Tenn.

THE APPLICATION OF GAS–CERAMIC MIXTURES TO NUCLEAR POWER. D. C. Schluderberg. Aug. 1955. Decl. Apr. 6, 1956. 42p. $2.80(ph OTS); $3.30(mf OTS).

Gas-ceramic mixtures appear to be ideally suited for use as reactor coolants and thermodynamic media in a closed cycle gas turbine type of nuclear power plant. With better coolant, thermodynamic, and nuclear properties than gases, and possessing unique system decontamination properties; these mixtures greatly improve the competitive position of this type of plant in relation to other types using liquids and vapors as reactor coolants and thermodynamic media respectively. (auth)

1318 CF-55-11-182

Oak Ridge National Lab., Tenn.

MECHANICAL AND THERMODYNAMIC DESIGN OF FREEZE UNITS FOR HRT PROCESS LINES. A. L. Gaines. Nov. 30, 1955. 39p. Contract [W-7405-eng-26]. $7.80 (ph OTS); $3.30(mf OTS).

Descriptions and calculation procedures for the mechanical and thermodynamic designs of the prototype freeze units for permanent or temporary use on the Homogeneous Reactor Test process piping are given. The mechanical design has been directed towards producing freeze units approaching as nearly as possible the requirements for unfired pressure vessels, while retaining the divided "clam-shell" construction. The heat transfer calculations have been based on the mechanical design, using equations derived herein which relax some of the assumptions made in studies. (auth)

1319 CRNE-558

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A TWO ZONE SLURRY REACTOR. M. F. Duret and I. L. Wilson. Dec. 1953. Decl. Nov. 9, 1955. 17p. (AECL-249).

A two-zone homogeneous reactor with slurry-type fuel is proposed and the calculations presented. The results are incorrect, being based on incorrect data, but suffice to show the benefits to be derived from a moderate amount of Pu enrichment. (T.R.H.)

1320 CRRP-669

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

RADIATION MONITORING OF NRU. W. J. Henderson. Oct. 1956. 8p. (AECL-363).

1321 DP-143

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

COMPUTER CALCULATIONS ON EXPONENTIAL DATA

R. R. Haefner. Jan. 1956. 34p. Contract AT(07-2)-1. $6.30(ph OTS); $3.30(mf OTS).

A routine was developed for the IBM 650 computer to obtain a least squares fit to data obtained in a subcritical reactor. The routine can obtain a hyperbolic sine fit when the absolute experimental uncertainty of the data is of the same magnitude at each point, a hyperbolic sine fit when the relative uncertainty is the same at each point, and a J_o (κr) fit when the relative uncertainty is the same at each point. (auth)

1322 GAT-189

Goodyear Atomic Corp., Portsmouth, Ohio.

CRITICAL GEOMETRIES FOR BARE CYLINDERS. J. A. Pond. July 20, 1956. 23p. Contract AT(33-2)-1. $0.25 (OTS).

A modified two-group treatment is used to study neutron transport in aqueous solutions of uranyl fluoride. For a bare reactor, the critical condition $k = \eta f U_t U_f = 1$ is investigated. This is tested on experimental data from critical mass studies. It is shown that an always-safe, unreflected cylinder diameter of 20 cm results from this argument as does an always-safe moderation, H/X = 2270. The derived safe radius for a cylinder of infinite length, $\bar{R}$, is developed as a function of moderation H/X. The derived critical radius for a bare sphere, R_s^{bc}, is expressed as a function of both U^{235} assay and moderation. The multiplication factor, k, is developed for a system of right circular cylinders in line. In each case, k is expressed in terms of $\bar{\Omega}_f$, the average fractional solid angle subtended by a cylinder on an adjacent cylinder. Data are presented for critical systems showing how nearly the condition k = 1 is satisfied by critical data taken from studies conducted by the Union Carbide Nuclear Company. (auth)

1323 HW-41053

[Hanford Atomic Products Operation, Richland, Wash.]

REGENERATION OF SILVER REACTORS. L. C. Amos. Dec. 27, 1955. 5p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

The current procedure for the regeneration of Ag reactors consists of wetting the reactor packing with $AgNO_3$ solution and then hot-air drying the packing. Recent regeneration studies indicate that this procedure is optimum as to quantity, concentration, and rate of addition of regenerant solution. (C.W.H.)

1324 KAPL-1226

Knolls Atomic Power Lab., Schenectady, N. Y.

POISONING IN THERMAL REACTORS DUE TO STABLE FISSION PRODUCTS. J. B. Sampson, W. L. Robb, J. R. Stehn, and J. K. Davidson. Oct. 4, 1954. Decl. July 19, 1956. 49p. Contract W-31-109-Eng-52. $6.30(ph OTS): $3.00(mf OTS).

Poisoning in a thermal reactor caused by stable fission products is evaluated from available data on fission yields and cross sections. The effects of nuclides which result from successive neutron captures in the primary fission products are included. Both U^{236} and U^{233} are considered as fuels. Replenishment of fuel to maintain constant fissionability is assumed. The range of exposures treated extends up to 10 fissions per original fuel atom (over 50,000 Mwd/t even in a natural uranium reactor). The decrease in fission product poisoning obtainable by removal of fission product gases is also calculated. Maximum and minimum limits of poisoning for fission products with poorly known cross sections are evaluated. The cross sections used are based largely on pile measurements, and to a lesser extent on thermal column measurements; in this analysis it is assumed that these values are equal and applicable to any "thermal" reactor. Poisoning build-up in U^{235} fueled reactors at low exposures can be described approximately by a rate of 65 barns per fission, which is uncertain to about a factor of 2. The predictability could be greatly improved by better measurements of the cross sections of Zr^{93} and Sm^{151}. (auth)

1325 KAPL-1549

Knolls Atomic Power Lab., Schenectady, N. Y.

TRIXY—A COMPUTER PROGRAM FOR MULTIGROUP NUCLEAR REACTOR CALCULATIONS IN THREE-SPACE DIMENSIONS. Paul Greebler. Aug. 1, 1956. 75p. Contract W-31-109-Eng-52. $0.45(OTS).

General features of a three-dimensional, multigroup code, now under development, are discussed. Geometric aspects of the calculational model are described; a numerical approximation of the age-diffusion equation is derived, and an iterative technique for solving the equation is described. Input data and general procedures for the computer solution of a problem are outlined. (auth)

1326 NAA-SR-104

North American Aviation, Inc., Downey, Calif.

NEUTRON PRODUCTION REACTOR EXPERIMENTS IN THE EXPONENTIAL ASSEMBLY. Sidney W. Kash, Elaine Martin, and E. Richard Cohen. Jan. 1, 1956. 18p. Contract AT-11-1-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

The effect on buckling by structural fuel assembly changes was determined. Additional information was gained by measuring thermal flux, disadvantage factor, thermal utilization, resonance escape, fast effect, age, and the flux ratio, in an exponential program for lattice studies for the design study of a natural $U-D_2O$ Neutron Production Reactor. (F.S.)

1327 ORNL-1866

Oak Ridge National Lab., Tenn.

OPERATION OF THE ORNL GRAPHITE REACTOR AND THE LOW-INTENSITY TEST REACTOR—1954. A. F. Rupp and J. A. Cox. Sept. 16, 1955. Decl. Aug. 14, 1956. 23p. Contract W-7405-eng-26.

Operations data for 1954 on the Graphite Reactor and LITR are reported. Available reactor data of general interest are appended. Graphite reactor information includes data on lattices, holdes and maximum thermal neutron flux, operating temperatures, shielding, control system, cooling system, and a new water demineralizer system. LITR information includes data on lattice, shielding, control system, flux measurements, and the cooling system. (D.E.B.)

1328 PWAC-157

Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.

HEAVY ELEMENT IMPURITY IN A BERYLLIUM SHIM SAFETY ROD. H. G. Simens, J. I. Mueller, and R. E. Mayes. Sept. 12, 1956. 17p.

By means of routine radiological monitoring techniques it was discovered that there was α radiation associated with the Be pieces in a Be shim safety rod for the MTR. Alpha pulse analysis of the α contamination showed it to be 99% Cm^{244} and 1% Cm^{242} and the Cm activity was a volume phenomenon and was not caused by surface contamination. Curium was produced by neutron capture in a 540 ppm U impurity in the preirradiated Be rod. (F.S.)

1329 WAPD-T-188

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

INHERENT REACTOR STABILITY. J. N. Grace, M. A. Schultz, and T. E. Fairey. Nov. 1954. 24p. $4.80(ph OTS); $2.70(mf OTS).

Reactivity feedback in thermal reactors is governed by coolant pressure and temperature and Xe concentration. An analysis of these factors was undertaken to determine the feasibility of eliminating external control systems in nuclear power plant designs. The analysis indicates a reactor with no external control may be unstable because of Xe feedback if the negative temperature coefficient is not large enough. Such a condition results in low-frequency flux oscillations on the order of one to two cycles per day. (D.E.B.)

1330 WAPD-TH-241

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

PRESSURE DROP THROUGH STAGGERED MULTIHOLE ORIFICES IN SERIES. (PWR BLANKET DESIGN). B. W. LeTourneau. Aug. 14, 1956. 13p. $3.30(ph OTS); $2.40 (mf OTS).

Pressure drop measurements have been made across a number of configurations of multihole orifice plates of the general design proposed for flow control in the PWR blanket region. Parameters investigated and their approximate ranges include flow rates from 40 to 500 gpm, orifice Reynolds numbers from 10,000 to 300,000, orifice hole diameters of $\frac{1}{8}$ to $\frac{3}{8}$ inches, orifice plate thicknesses of $\frac{1}{8}$ and $\frac{3}{16}$ inches, number of plates from 1 to 8, spacing of multiple plates from 0.16 to 2.25 inches, and square and rounded edged holes. All plates tested had 41 holes on a 0.486 inch pitch located in a 4.195 inch bore diameter. All multiple plate runs had the holes of adjacent plates staggered with respect to each other. Results are presented in graphical and tabular form as pressure loss coefficients (pressure loss per unit velocity head) for various geometrical configurations. Orifice Reynolds number in most cases had negligible effect. Accuracy is estimated to be ±10%. (auth)

1331 WIAP-7

Westinghouse Electric Corp. Industrial Atomic Power Group, Pittsburgh.

PROPOSED 80,000 KILOWATT PRESSURIZED WATER REACTOR PLANT. PLANT DESIGN AND COST ESTIMATE. Feb. 1955. Changed from OFFICIAL USE ONLY May 17, 1956. 77p. $12.30(ph OTS); $4.50(mf OTS).

The results of a preliminary study of a pressurized light water nuclear power plant, with a reactor heat output of 300 Mw and a net electrical output of 80,000 kw are summarized. The reactor is designed to utilize high or low enrichment cores. The function of the plant is to produce reliable nuclear power and to obtain operation data. (F.S.)

1332 WIAP-M-7

Westinghouse Electric Corp. Industrial Atomic Power Section, McKeesport, Penna.

A STUDY OF TEMPERATURE DISTRIBUTION THROUGH A REACTOR IN THE AXIAL DIRECTION. A. R. Jones. Apr. 23, 1953. Changed from OFFICIAL USE ONLY May 17, 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

Relationships between the hot-spot temperatures, the coolant inlet temperature and the coolant temperature rise were developed. (F.S.)

1333

THE PHYSICS OF NUCLEAR REACTORS. A CONFERENCE ARRANGED BY THE INSTITUTE OF PHYSICS IN LONDON FROM JULY 3 TO 6, 1956. Brit. J. Appl. Phys. Suppl. No. 5, 1956. 110p.

Papers and discussions from the Conference on the Physics of Nuclear Reactors held in London from July 3-6, 1956 are given. Papers were presented on fast reactors; recent developments in nuclear theory; radiation effects on the physical properties of solids; instrumentation, shielding and control of reactors; and the roles of chemistry and metallurgy in nuclear energy. (F.S.)

1334

CALDER HALL. Nuclear Eng. 1, 266-303(1956) Oct.

The worlds first large scale Nuclear Power Station at Calder Hall is discussed. The design and construction of the reactor, pressure vessel, fuel charge and discharging gear, control rods, burst slug detection gear, heat exchangers, coolant gas systems, graphite placing and civil engineering problems are included. (F.S.)

1335

THERMAL NUCLEAR REACTOR, IN PARTICULAR FOR AIRCRAFT PROPULSION. H. P. G. A. R. von Zborowski (France). British Patent 754,559. Nuclear Eng. 1, 316 (1956) Oct.

The system has a reserve of fissionable material with at least two wall portions opposite each other between which a moderator fluid can pass. The whole mass of fissionable material is chosen so that it is 1.01 to 1.1 times the "slow" critical mass (0.01 of the fast critical mass). The moderator is supplied under pressure and the rate of flow so chosen that the moderator leaves the passage in gaseous form and the multiplication factor is equal to 1 in normal running conditions. The nuclear generator then has automatically a stable output. (auth)

1336

CALDER HALL. Nuclear Power 1, 276-94(1956) Nov.

The power plant of Calder Hall is described including the description and uses of the turbines, steam cycle, steam control after a shutdown, normal steam dumping, controlled by oil operated valves connected to the pressure regulators and governors, faulty operation dumping by discharge to the atmosphere, water treatment to prevent scaling by ion exchange, demineralization and deaeration, and the hyperbolic reinforced concrete cooling towers. (F.S.)

1337

REACTOR PHYSICS. 6. James F. Hill (Reactor School., Harwell, Berks, England). Nuclear Power 1, 306-9(1956) Nov.

Factors governing neutron multiplication in a homogeneous medium are discussed and the variations in the number of fission neutrons produced per neutron absorbed in the fuel with the fraction of U-235 in the fuel are found. The resonance escape probability and thermal utilization are found to depend on the amount of moderator present. A homogeneous mixture of graphite and moderator is used to illustrate the effect on the multiplication constant by increasing the uranium enrichment. The equations for the spatial distribution of slowing-down and diffusing neutrons in an infinite multiplying medium are derived. This introduces the quantity known as "buckling" which is a function of the multiplication constant and the slowing-down and diffusion lengths in the medium. (auth)

1338

U-233 BREEDER- U-235 CONVERTER REACTOR. L. I. Katzin and B. I Spinrad. (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 343-54(1956) Oct.

A description of a fluid-fuel-fluid-absorber thermal reactor for the production of U^{233} is presented herein, and the conditions for maximum efficiency as a breeder (shortest doubling time) are elaborated. With very little modification of operating conditions and no modifications in the structure, the machine shows promise as an efficient U^{235}–U^{233} converter, with the possibility also of by-product power. Some of the development work required is indicated. In particular, achievement of high pumping rates for maximum heat transfer and fabrication of very thin-walled zirconium tubing pay large dividends. (auth)

1339

EVALUATION OF ln E_1/E_2 FOR RESONANCE NEUTRONS IN URANIUM LATTICES. F. L. Fillmore (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 1, 355-8(1956) Oct.

The calculation of the resonance escape probability in a lattice by means of a diffusion theory model requires a knowledge of the logarithmic energy width, ln E_1/E_2, of the resonance absorption region. This quantity is evaluated by fitting the results of a diffusion theory analysis which is averaged over neutron energy to an experimental value of the effective resonance integral. The result is ln $E_1/E_2 \simeq$ 2.6, which is much less than the value 5.6 which is ordinarily used in these calculations. (auth)

1340

ENGINEERING HOT CHANNEL FACTORS FOR NUCLEAR REACTOR DESIGN. B. W. LeTourneau and R. E. Grimble (Westinghouse Electric Corp., Atomic Power Div., Pittsburgh). Nuclear Sci. and Eng. 1, 359–69(1956) Oct.

In the thermal design of nuclear power reactors having parallel coolant channels, engineering hot channel factors have been established to account for small dimensional deviations from the nominal design of the reactor fuel elements resulting from manufacturing tolerances, and for departures from ideal flow conditions. A description of the various deviations from nominal likely to be encountered in a practical reactor design is presented, together with methods for estimating the magnitude of the effect of each on channel enthalpy rise, film temperature difference, and maximum heat flux. Examples are given for a geometry consisting of parallel plate type fuel elements separated by rectangular coolant channels. (auth)

1341

FISSION RECOIL SEPARATION OF FISSION PRODUCTS IN POWER REACTOR DESIGN. Richard Wolfgang (Florida State Univ., Tallahassee, Fla.). Nuclear Sci. and Eng. 1, 383-90(1956) Oct.

Nuclear recoil of fission fragments can, under suitable conditions, carry them out of the fissile material. In effect this offers a method by which fission wastes can separate themselves without further chemical processing. This paper seeks to evaluate the feasibility of applying this concept of fission product separation by recoil to nuclear power reactors. It is concluded that there seem to be no inherent difficulties in designing a "recoil-separating" reactor that would be a breeder and also embody other features desirable in economical power reactor operation. An especially important advantage of such a system is that the fission products could readily be produced in carrier-free form. The various possible types of reactors using the recoil separation principle are briefly considered and a design, which appears the most promising at the present time, is discussed in some detail. (auth)

1342

MEASUREMENT OF NEUTRON SPECTRA OF THE EXPERIMENTAL BREEDER REACTOR. C. Eggler, C. M. Huddleston, V. E. Krohn, and G. R. Ringo (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 391-408(1956) Oct.

The neutron spectra at two positions in the core and two positions in the inner blanket of the Experimental Breeder Reactor in Idaho have been measured by means of beams extracted from these positions. The energy range covered was from 75 kev to 4 Mev. A cloud chamber was used for the measurement from 75 kev to 1 Mev and recoil-proton tracks in nuclear plates for that from 0.8 to 4 Mev. Reaction rate ratios measured inside the reactor agree well with those calculated from known cross sections and the spectra found in the beams. (auth)

1343

OPERATIONAL EXPERIENCE WITH THE BORAX POWER PLANT. W. H. Zinn, H. Lichtenberger, M. Novick, G. K. Whitham, C. J. B. Zitek, J. C. Feldes, V. C. Hall, Jr., and R. O. Haroldsen (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 420-37(1956) Oct.

The Borax-III power system operated for about 1170 hours at 300 psig. The steam generated in the reactor was fed directly to a turbine. Tests were conducted on maintaining the pH and quality of the reactor water. Checks were made on the carryover of activity into portions of the system external to the reactor vessel. Neither of these points appear to be major problems in a direct cycle boiling system. Water decomposition was measured under various water conditions. (auth)

Refer also to abstracts 1031 and 1123.

NUCLEAR TRANSFORMATION

1344 NRL-4821

Naval Research Lab., Washington, D. C.

PROTON RESONANCES IN Na^{23}. Interim Report. J. W. Teener and L. A. Beach. Aug. 6, 1956. 10p. Project No. NR-540-007.

Some of the previously observed resonances in the gamma-ray yield from proton bombardment of Na^{23} have been re-examined using a technique by which it is possible to differentiate between the various competing processes. It has been found that at least two of the resonance structures are more complex than had been reported. Cascade gamma-ray energies were measured at some of the more prominent resonances and the observed lines fit well into the known energy level diagram for Mg^{24}. (auth)

1345

FORMATION OF Be^{10} FROM B^{10}. M. B. Crespi and A. E. Cairo (Comisión Nacional de la Energía Atómica, Buenos Aires, Argentina). J. Inorg. and Nuclear Chem. 3, 248-9 (1956) Oct.

Experiments involving the recovery of BeO from B_4C (from a discarded BEPO shut-off rod) are described. The results indicate a cross section for the reaction B^{10} (n,p) Be^{10} of > 7 mb. Previous estimates were ~3 mb, thus the alternative reactions C^{13}, (n,α) and Be^{9} (n,γ) appear much less probable. (T.R.H.)

1346

ANGULAR DISTRIBUTIONS OF THE GAMMA RAYS FROM THE REACTION $Na^{23}(p,\gamma)Mg^{24}$. F. W. Prosser, Jr., N. P. Baumann, D. K. Brice, W. G. Read, and R. W. Krone (Univ. of Kansas, Lawrence). Phys. Rev. 104, 369-75(1956) Oct. 15.

Resonances occurring in the compound nucleus Mg^{24} resulting from the proton bombardment of sodium have been studied in the energy range from $E_p = 0.58$ to $E_p = 1.50$ Mev. Ten resonances were found to have a relatively large yield of capture gamma rays. The cascades leading to the ground state of Mg^{24} were determined and found to proceed for the most part through well-known lower lying states. The angular distribution of the first gamma ray emitted in the decay was measured for six of these resonances. The resonance energies in Mev and the corresponding assignments for spin and parity are the following: $E_p = 0.595$, 0.676, 0.740, 0.744, 0.877 (1+), 0.989 (4±), 1.022 (2−), 1.321 (3+), 1.398, 1.419 (4+). (auth)

1347

APPROXIMATION FOR DEUTERON STRIPPING REACTIONS ON HEAVY TARGET NUCLEI. L. C. Biedenharn, K. Boyer, and M. Goldstein (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 104, 383-6(1956) Oct. 15.

The (d,p) stripping reaction for $l_n = 0$ is discussed for the

case where Coulomb effects predominate, employing a zero-range neutron-proton interaction and neglecting the finite nuclear size. The angular distribution of the emergent proton is shown to change drastically from forward to backward peaking as the Sommerfeld number η increases. The case $l_n \neq 0$ is discussed. (auth)

1348

$N^{15}(d,p)N^{16}$ REACTION AND THE LOW EXCITED STATES OF N^{16}. W. Zimmermann, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 104, 387-9(1956) Oct. 15.

The angular distributions of proton groups to the first three excited states of N^{16} produced in the reaction $N^{15}(d,p)N^{16}$, have been measured at $E_d = 2.75$ Mev in the laboratory system. These distributions show strong resemblance to the predictions of stripping theory and have been compared to curves calculated from the formula for the differential cross section given by Bhatia et al. The most reasonable values of l_n in the reactions leading to the states at 0.113, 0.300, and 0.391 Mev are $l_n = 0$, 2, and 0, respectively, indicating spin and parity assignments 0^- 1^-; 1^-, 2^-, or 3^-; and 0^- or 1^-, respectively, for these three states. (auth)

1349

CROSS SECTIONS FOR THE $T(d,n)He^4$ REACTION. A. Galonsky and C. H. Johnson (Oak Ridge National Lab., Tenn.). Phys. Rev. 104, 421-5(1956) Oct. 15.

Differential cross sections for the $T(d,n)He^4$ reaction have been measured as a function of energy at $\theta_n = 0^0$ (c.m.) from $E_d = 1.0$ to 5.0 Mev and as a function of angle at $E_d = 1.53$, 2.21, 3.05, 3.97, 4.98, and 5.79 Mev. The estimated uncertainties are within the range ± 8% to ± 11%. Although no sharp anomaly appears in the 6° excitation curve, there is a slow increase of ~ 50% from 2.5 to 5 Mev. In this energy region the total cross section is flat or, perhaps, even slightly rising with increasing energy; whereas below 2.5 Mev it is a sharply decreasing function of energy. When compared with the much lower cross section reported at $E_d = 10.5$ Mev, the present data may indicate a new level of He^5 with an excitation of ~ 22 Mev. The angular distributions, however, do not lend direct support to the resonance assumption since they are asymmetrical and contain large forward peaks. (auth)

1350

PHOTOFISSION AND PHOTONEUTRON EMISSION IN THORIUM AND URANIUM. J. E. Gindler and J. R. Huizenga (Argonne National Lab., Lemont, Ill.) and R. A. Schmitt (Univ. of Illinois, Urbana). Phys. Rev. 104, 425-33 (1956) Oct. 15.

Yield-energy relations have been determined radiochemically for the photofission and photoneutron reactions in Th^{232} and U^{238}. Excitation functions for the various reactions have been obtained by photon difference analyses of the corresponding yield functions. The photofission branching ratio for excitation energies of 8 to 11 Mev has been calculated to be approximately 0.08 for thorium and 0.2 for uranium. The relative photofissionability of thorium to uranium has been found to be about 2.3 times greater at betatron energies of 7 to 8 Mev than at 20 Mev. Also, evidence for bumps in the photofission excitation functions at about 6 Mev has been observed. Tentative explanations are presented for the relative photofissionability change and the bumps in the excitation functions. Characteristics of crude $(\gamma,2n)$ excitation functions are given for the two nuclides. (auth)

1351

SPALLATION-FISSION COMPETITION IN HEAVIEST ELEMENTS; HELIUM-ION-INDUCED REACTIONS IN PLUTONIUM ISOTOPES. Richard A. Glass, Robert J. Carr, James W. Cobble, and Glenn T. Seaborg (Univ. of California, Berkeley). Phys. Rev. 104, 434-48(1956) Oct. 15.

Excitation functions have been determined for the spallation and fission reactions induced in plutonium isotopes by 20- to 50-Mev helium ions. The method employed consists of cyclotron bombardments of plutonium oxide followed by the chemical isolation and alpha or beta counting of radioactive reaction products. Formation cross sections are given where possible for the curium and americium spallation products corresponding to (α,n), $(\alpha,2n)$, $(\alpha,3n)$, $(\alpha,4n)$, $(\alpha,5n)$, (α,p), $(\alpha,pn$ or $d)$, $(\alpha,p2n$ or dn or $t)$, and $(\alpha,p3n$ or $d2n$ or $tn)$ reactions in Pu^{238}, Pu^{239}, and Pu^{242}. Fission yield curves and fission cross sections for Pu^{238} and Pu^{239} serve to define the characteristics of the (α,f) reaction for plutonium isotopes. Chemical procedures are outlined for the separation of both spallation and fission-product elements in a sequence of operations performed on the entire dissolved target. The small spallation and large fission cross sections observed indicate that fission competes successfully for most of the total reaction cross section in the energy range studied. Analysis from a compound nucleus viewpoint of the cross sections for the surviving (α,xn) products reveals meant Γ_f/Γ_n values for compound and intermediate compound nuclei from 1 to 7, the value decreasing with increasing mass number and apparently not greatly dependent on excitation energy above fission and neutron-emission thresholds. The relatively high cross sections ("tails") evident in the spallation excitation functions beyond their maxima constitute evidence for processes other than compound nucleus formation, e.g., direct interaction. Even more convincing evidence for non-compound-nucleus processes is seen in the fact that the cross sections for (α,pxn) reactions are of the same order of magnitude as (α,xn) cross sections. Their explanation rests strongly on the supposition that the ejection of high-energy protons, deuterons, and tritons occurs leading to residual intermediate nuclei of low excitation energy, which then escape from fission. This unique description of the escape of charged particle emission reactions from fission competition is believed to have wide application for the explanation of spallation cross-section data in the heaviest element region. Fission yield curves for Pu^{238} and Pu^{239} have been constructed from the production cross sections (mass chain yield plus direct production) for the isotopes $Br^{82,83}$, $Sr^{89,91,92}$, Ru^{105}, $Cd^{115,115m,117}$, $I^{131,133}$, $Ba^{139,140}$, $Ce^{143,145}$, Nd^{147}, $Eu^{156,157}$, and Tb^{161}. The more complete curves for Pu^{239} show a change with increasing energy from asymmetric to symmetric fission for about 40-Mev helium ions accompanied by an increase in number of neutrons lost, as determined by the best fit of reflection points. Integration of the fission yield curves gives total fission cross sections for various energies which, when combined with the appropriate total spallation cross sections, define a total reaction cross-section function consistent with a nuclear radius parameter in the range of $(1.3-1.6) \times 10^{-13}$ cm. Further investigations in the present series should elucidate the effects of Z and A upon fission competition. (auth)

1352

$C^{13}(\gamma,p)B^{12}$ CROSS SECTION. B. C. Cook, A. S. Penfold, and V. L. Telegdi (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 104, 554-5(1956) Oct. 15.

The (γ,p) cross section was derived from B^{12} yield curve by using tables for the inverted bremsstrahlung spectrum. The cross section curve shows a broad maximum of 8.8 mb near 25.5 Mev. Features of the cross section curve are compared to those for the $C^{12}(\gamma,p)B^{11}$ reaction. (B.J.H.)

1353

THE PROTON GAMMA ANGULAR CORRELATIONS IN THE $^{28}Si(d,p\gamma)^{29}Si$ STRIPPING REACTION. K. W. Allen,

B. Collinge, B. Hird, B. C. Maglic, and P. R. Orman (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A69, 705-12(1956) Sept.

The angular correlation between the protons and γ rays from the reaction $Si^{28}(d,p\gamma)Si^{29}$ has been measured. Protons were selected which correspond to the excitation of the 1.28 Mev level in Si^{29}, the proton counter being set on the maximum of the stripping angular distribution at 30° to the deuteron beam direction. The angular correlation in the plane of scattering was found to be in agreement with the simple stripping hypothesis, but measurements in a plane perpendicular to the direction of the absorbed neutron, which according to the simple theory is an axis of symmetry, showed significant anisotropy. (auth)

PARTICLE ACCELERATORS

1354 AECU-3198

Stanford Univ., Calif. Microwave Lab.

PREBUNCHING BY VELOCITY MODULATION IN LINEAR ACCELERATORS. E. A. Smars. Apr. 1956. 24p. Contract AT(04-3)-21. (ML-303). $6.30(ph OTS); $3.00 (mf OTS).

Methods of prebunching the electron beam by velocity-modulation techniques prior to injection into a linear accelerator are discussed. A particular method (i. e., bunching at the injection energy) is analyzed in detail for one- and two-cavity bunching. The physical design of a single-cavity prebuncher is given for a modulation voltage 10% of the injection voltage and a drift space of 40 cm. (auth)

1355 ANL-5630

Argonne National Lab., Lemont, Ill.

PARTICLE ACCELERATOR DIVISION SUMMARY REPORT [FOR] APRIL THROUGH SEPTEMBER 1956. Oct. 1956. 47p. Contract W-31-109-eng-38. $0.35(OTS).

A general description is included on the 12.5-Bev proton synchrotron. The energy of 12.5 Bev for the accelerator was chosen because it seems desirable to have an accelerator of intermediate energy, because the system is adequate for the production of all known particles, and because existing techniques of particle detection and analysis are applicable. The factors in the choice of the type of machine are discussed. The advantages to a high injection energy are listed. The possibilities of using either a linear accelerator or a cyclotron for the injector were studied. Brief discussions are also included on betatron oscillation frequencies, vacuum chamber size and beam intensity, magnet dimensions, and the r-f accelerating system. Tentative parameters of the synchrotron are listed. General instrumentation work is reviewed. Model magnet power requirements were also studied. The instrumentation required for accurate magnetic measurements on model magnets is discussed. Complete descriptions are given of a d-c model magnet. The general characteristics of r-f accelerating systems and a ring magnet power supply are described. Preliminary schemes of magnet water cooling systems were studied. Various proposals for vacuum chamber design are listed. Soil conditions at the proposed accelerator site were studied. A conceptual design of the accelerator building is also shown. (B.J.H.)

1356 CERN-56-21

European Organization for Nuclear Research, Geneva.

THE DESIGN OF THE FOUNDATIONS FOR THE MAGNET OF THE CERN ALTERNATING GRADIENT PROTON SYNCHROTRON. J. B. Adams. Oct. 1, 1956. 62p.

The work carried out to establish a design for the foundations of the Alternating Gradient Proton Synchrotron which requires that the magnet units of the magnet should be set up to a prescribed figure in a perfect plane to a tolerance of 0.1 mm is described. (F.S.)

1357 UCRL-3444

California. Univ., Berkeley. Radiation Lab.

BEVATRON OPERATION AND DEVELOPMENT. IX. [Period covered] February, March, April 1956. Walter Hartsough. June 6, 1956. 26p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The counter lifetime measurements of τ^+, $K_{\mu 2}^+$, and $K_{\pi 2}^+$ mesons were continued. A search was also made for the Lee-Orear γ ray. K^--meson absorption in hydrogen was done, using the 10-inch liquid-hydrogen bubble chamber. A cloud-chamber mass spectrometer was used to study K-meson production, interaction, and decay. The properties of the new Quadrant III forward-angle K^--meson beam were investigated, using emulsions and counters. Total and absorption cross-section studies for π^- mesons continued. Identification of heavy mesons and a study of their π^0 modes of decay were done. A study was made of the dual nature of θ^0 mesons. Proton-proton scattering measurements were continued at 2, 4, and 6.1 Bev, using counters. The following emulsion exposures were made for groups outside the laboratory; emulsion exposures in the neutron beam for two groups; internal exposures to protons for five groups; twenty emulsion exposures to K^+ mesons and K^0 mesons for nine groups; exposures to π^- mesons for seven groups. Studies were made of the slow and fast structure of secondary-particle beams. The effectiveness of the beam clipper was measured for three energies. The production of a spatially uniform beam distribution on a target was investigated. (For preceding period see UCRL-3332.) (auth)

1358 UCRL-3476

California. Univ., Berkeley. Radiation Lab.

EXTRACTION OF SYNCHROCYCLOTRON BEAMS NEAR THE MAXIMUM ENERGY. Warren Fenton Stubbins. July 23, 1956. 18p. Contract W-7405-eng-48. $0.20 (OTS).

A statement of the requirements for regenerative extraction of particles from a cyclotron in the nonlinear magnetic field is followed by an analysis for determining the regenerator shape and position and estimating the rate of increase of radial oscillation amplitude. The effect of the regenerator on axial motion is considered briefly. The regenerator field is computed for several regenerator positions as an illustrative example. (auth)

1359

CYCLOTRON WITH A SECTIONAL MAGNET. E. M. Moroz (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 108, 436-9(1956) May 21. (In Russian)

A theory of design for the construction of a sectional cyclotron magnet and the motion stability of particles and resonances are discussed. (R.V.J.)

1360

AN IMPROVED DESIGN OF RADIO-FREQUENCY ION SOURCE. H. R. Allan and N. Sarma (Imperial Coll. of Science and Tech., London). J. Sci. Instr. 33, 447-8(1956) Nov.

Improving the design of a radio-frequency ion source by introducing a quartz bottle in place of the inner envelope is discussed. The bottle sits on an adjustable platform and can be moved up or down so that the height above the canal may be accurately controlled, and changing the bottle makes it relatively simple to prevent coating that reduces the percentage of monatomic ions. (J.H.M.)

1361

MODES OF ACCELERATION OF IONS IN A THREE-DEE CYCLOTRON. Mark Jakobson, Myron Heusinkveld, and

Lawrence Ruby (Univ. of California, Berkeley). Phys. Rev. 104, 362-5(1956) Oct. 15.

Formulas are presented for the maximum energy gain per turn of ions in a fixed-frequency cyclotron with three identical dees symmetrically spaced. Calculations have been made for dees of general angle θ and specific angles 60°, 90°, and 120°. Dee excitations in which the dee voltages are all in phase or phased at 120° with respect to each other have been considered. The type of ions that can be accelerated is dependent upon the mode of excitation. In a 60° three-dee cyclotron with variable rf phasing, protons, deuterons, and tritons can be accelerated in the nonrelativistic energy region at substantially the same magnetic field and oscillator frequency. A 20-inch cyclotron of this type has been operated successfully. (auth)

1362

FIXED FIELD ALTERNATING-GRADIENT ACCELERATORS. L. Jackson Laslett. Science 124, 781-7(1956) Oct. 26.

Developments in the design of cyclic accelerators employing magnetic fields that are constant in time are discussed. Engineering advantages are discussed. (C.H.)

Refer also to abstract 1208.

RADIATION ABSORPTION AND SCATTERING

1363 WAPD-TM-5

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A NUMERICAL INTEGRATION TECHNIQUES FOR COMPUTING THE MEAN THERMAL DIFFUSION COEFFICIENTS. P. G. Roll and R. S. Varga. June 1956. 22p. Contract AT-11-1-GEN-14. $0.25(OTS).

The integral expression for the mean thermal diffusion coefficient $\bar{D}_s$ is evaluated by means of Gauss-Laguerre numerical integration formula. The errors involved in the use of this quadrature method are investigated and found to be negligible. Finally, a simple means of applying the method is presented, along with the necessary numerical tables for a variety of temperatures. (auth)

1364

SCATTERING OF CLASSICAL ELECTRONS BY NUCLEI. S. P. Heims, D. G. Ravenhall, and D. R. Yennie (Stanford Univ., Calif.). Am. J. Phys. 24, 568-73(1956) Nov.

A study is made of the scattering of extremely relativistic classical charged particles by a distribution of charge. The approximation is made that the mass of the scattered particle can be neglected; this is valid for the energies used in the experiments (between 100 and 200 Mev). In the case of the point charge there appear orbits in which the particle encircles the nucleus many times before emerging. Cross sections are obtained for this case, for the spherical shell, and for the "smoothed uniform" charge distribution. From these results it is clear that the experimentally interesting region is completely inaccessible to classical particles, and that the process observed corresponds more to the diffraction of waves. (auth)

1365

ELASTIC SCATTERING OF PROTONS BY PROTONS AT ENERGY LEVELS OF 460, 560, AND 660 MEV AT SMALL ANGLES. N. P. Bogachev (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 108, 806-8(1956) June 11. (In Russian)

Tables are given for differential cross sections of p-p scattering in energies of 460, 560, and 660 Mev at small angles (in units of 10^{-27} cm^2 sterad^{-1}), and for total cross sections of elastic and inelastic processes of p-p interactions (in units of 10^{-27} cm^2). The tables show that the total cross sections for elastic p-p scattering at energy levels of 460 and 660 Mev, within the experimental error, remained constant. The data for the total cross section of the $p + p \rightarrow n + p + \pi^+$ reaction showed that with the energy increase from 460 to 660 Mev the total cross sections enlarged about six times. (R.V.J.)

1366

EFFECT OF PROTON-PROTON SCATTERING ON AN INITIAL LONGITUDINAL SPIN POLARIZATION. James E. Simmons (Univ. of California, Berkeley). Phys. Rev. 104, 416-18(1956) Oct. 15.

The Wolfenstein A parameter for proton-proton scattering is measured for three angles at an incident laboratory energy of 316 Mev. (auth)

1367

APPLICATION OF VARIATIONAL METHODS TO THE THEORY OF THE SCATTERING OF SLOW ELECTRONS BY HYDROGEN MOLECULES. H. S. W. Massey and R. O. Ridley (Univ. Coll., London). Proc. Phys. Soc. (London) A69, 659-67(1956) Sept.

The cross section for the elastic scattering of slow electrons by molecular H is calculated by use of the variational methods of Hulthén and of Kohn, full allowance being made for electron exchange. The trial wave function is assumed to have a form which in spheroidal coordinates resembles the analogous functions in spherical polar coordinates used in discussing elastic scattering by H and He atoms. Quite good agreement is obtained with observed data — an agreement which disappears when exchange is neglected; this is a situation similar to that which arises in the case of He. (auth)

1368

THE INELASTIC SCATTERING OF NUCLEONS BY THE SURFACE INTERACTION. S. Yoshida (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A69, 668-85(1956) Sept.

The effect of the surface interaction, based on A. Bohr's collective model, on the inelastic scattering of nucleons by a nucleus at medium energy is discussed. The wave function is expressed as a sum of amplitudes, which correspond to various states of target nucleus and incident nucleon. From the Schrödinger equation one can derive a set of coupled equations for the amplitudes, which correspond to a state of the surface excitation while the effect of the other amplitudes is replaced by distorting potentials. The interaction between the states considered explicitly is assumed as the surface interaction proposed by A. Bohr, and taken to have a δ-function type radial dependence. The coupled equations are solved without further approximation. The distorting potential is chosen so as to give the right result for the elastic scattering in the presence of the surface interaction. If that interaction is strong enough, the distorting potential differs considerably from the usual optical potential, which would give a good result for the elastic scattering in the absence of surface interaction. The theory is applied to proton scattering by Mg^{24} at 10 Mev, and the result shows that the strong angular dependence of the inelastic scattering is due to the surface interaction while the main contribution comes from the compound nucleus. (auth)

1369

THE SCATTERING OF 9.6 MEV PROTONS BY Mg. G. W. Greenlees and A. E. Souch (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A69, 686-90(1956) Sept.

Absolute differential cross sections are given for the elastic and inelastic scattering of 9.62 Mev protons by Mg for an angular range of 25° to 145° (laboratory coordinates). For scattering by the 1.37 Mev level of Mg^{24}, the angular distribution is also given for an incident energy of 8.86 Mev. A marked difference in angular distribution at the two energies is noted. (auth)

RADIATION EFFECTS

1370 AD-89082
Sylvania Electric Products, Inc. Atomic Energy Div., Bayside, N. Y.
EFFECT OF IRRADIATION ON SOLIDS. A Bibliography. Henry H. Hausner and Helen C. Friedemann. [nd]. 20p.

1371 AERE-C/R-1901
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
RADIATIONS FROM WATER UNDER BETA-PARTICLE BOMBARDMENT. E. W. T. Richards. Mar. 1956. 19p.

Experiments are described in which the light emission from water under electron bombardment was studied. The variation in the intensity and spectrum of the emitted light was investigated as a function of the energy of the bombarding particles. An attempt was made to determine the precise angular distribution but this was only partially successful due to experimental difficulties. Finally, a direct measurement of the quantum efficiency of the emission processes is described. The results obtained are in general agreement with those predicted by the Cerenkov theory for bombarding energies of greater than 0.26 Mev, the Cerenkov threshold. However, below this energy light emission takes place although at a greatly reduced efficiency. This emission might be that predicted by Lawson although the efficiency observed tends to indicate some other process. (auth)

1372 BNL-414
Brookhaven National Lab., Upton, N. Y.
FISSION PRODUCTS UTILIZATION. IX. STUDIES ON RADIATION-INDUCED GRAFT COPOLYMERIZATION AND SOLID STATE POLYMERIZATION. Progress Report. D. S. Ballantine, P. Colombo, A. Glines, B. Manowitz, and D. J. Metz. Oct. 1956. 18p. $0.20(OTS).

A wide variety of graft copolymers have been prepared by the irradiation of a polymer in the presence of a monomer with Co^{60} gamma-rays. Some of the kinetic aspects of various systems are presented, and a partial physical evaluation of several of the graft copolymers formed is given. (auth)

1373 ORNL-1817
Oak Ridge National Lab., Tenn.
PRODUCTS PRODUCED IN CONTINUOUS NEUTRON IRRADIATION OF THORIUM. A. T. Gresky and E. D. Arnold. Feb. 16, 1956. Decl. Sept. 7, 1956. 63p. Contract W-7405-eng-26. $0.50(OTS).

Calculated data and graphs describing the effects of continuous thermal-neutron irradiation of Th, the usual method of operation of homogeneous reactors, are presented. The buildup and decay of U^{233}, Pa^{233}, other heavy isotopes, and fission products are considered on the basis of best available cross-section and fission-yield data. The effects of the heavy isotopes and fission products on neutron economy are discussed. (auth)

1374 ORNL-2174
Oak Ridge National Lab., Tenn.
GAMMA RADIATION DAMAGE STUDIES OF ORGANIC PROTECTIVE COATINGS AND GASKETS. J. C. Bresee, C. D. Watson, and J. S. Watson. Nov. 8, 1956. 32p. Contract W-7405-eng-26. $0.30(OTS).

Studies have been carried out on the effect of gamma irradiation on mounted and unmounted protective coatings and various gasket materials. Qualitative results of screening studies and quantitative results of decontamination tests and physical property measurements are reported. (auth)

1375 WAPD-AD(P)-987
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
EFFECTS OF IRRADIATION AND CORROSION ON STAINLESS STEEL WELDED JOINTS IN PRESSURIZED WATER REACTORS. L. C. Grimshaw. [May 1955]. Changed from OFFICIAL USE ONLY Oct. 23, 1956. 6p. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80(mf OTS).

After approximately 2900 hr exposure in the Mark I system at temperature and pressure, a fillet weld between pipe and coupling was found to have suffered no damage from corrosion. No crevice corrosion was observed between pipe and coupling, or in the root. There was no cracking at the root. There was present about 2% of ferrite in the weld deposit. Weld, pipe, and coupling were type 347 stainless steel. It was observed that despite the fact that the deposited weld metal was out of chemical specification, being too high in carbon and hence low in the amount of ferrite in its structure, there was no evidence of cracking, either at the time of making the weld, or during life in service. (auth)

1376
TREATMENT OF POLYMERIC SUBSTANCES. A. Charlesby (to U. K. Atomic Energy Authority). British Patent 749,680. Nuclear Eng. 1, 316(1956) Oct.

If long chain polymeric substances of alternate silicon and oxygen atoms, having substituents attached to the silicon atoms, are subjected to ionizing radiation by gamma rays, high energy neutrons, deuterons, helium ions, protons, electrons in a thermal nuclear reactor appreciable cross linking of the polymer chains will be produced. (auth)

RADIOACTIVITY

1377 BNL-2565
Brookhaven National Lab., Upton, N. Y.
THE DESIGN OF A MEGACURIE COBALT-60 SOURCE. B. Manowitz, D. J. Metz, and R. H. Bretton. [1955]. 24p. $4.80(ph OTS); $2.70(mf OTS).

The economic feasibility of producing megacurie quantities of Co^{60} in power reactors has been demonstrated. It has been shown that, under the conditions of geometry discussed, such a radiation source could be assembled in a practicable manner to render a very large dose rate over an extended area. The problems of safety and economically transporting such a source in a single shipment have been discussed at length and the design of a facility to accomplish this has been given. (auth)

1378 USNRDL-TR-108
Naval Radiological Defense Lab., San Francisco.
GAMMA RADIATIONS FROM A ROUGH INFINITE PLANE. C. F. Ksanda, A. Moskin, and E. S. Shapiro. Jan. 18, 1956. 11p. Project NS 083-001.

The gamma radiation above a uniformly contaminated ground area was related to the activity concentration on the ground by assuming that a uniform mixture of radioactivity is distributed through a top layer of ground surface whose effective thickness depends on the roughness. (F.S.)

1379
INCREASE IN γ-RADIATION FROM POWDERED MILK AND BEEF, 1953-56. R. M. Sievert, S. Gustafsson, and C. G. Rylander (Institute of Radiophysics, Stockholm, Sweden). Nature 178, 854-5(1956) Oct. 20.

Samples of powdered milk and beef preserved during the years 1953 to 1956 were examined for the presence of γ radiation. The higher γ-radiation found in the last year

was attributed to an increase in fission products. Data are compared with measurements on a series of children. (C.H.)

1380

RADIATIVE ELECTRON CAPTURE IN CESIUM-131. D. D. Hoppes and R. W. Hayward (National Bureau of Standards, Washington, D. C.). Phys. Rev. 104, 368-9(1956) Oct. 15.

The continuous electromagnetic radiation accompanying orbital electron capture in cesium-131 has been investigated with a scintillation spectrometer. The intensity distribution as a function of energy may be accounted for by the theoretical predictions of Glauber and Martin. The end-point energy of the 1S electron capture contribution to the continuous spectrum is 320 ± 10 kev. (auth)

1381

ALPHA-DECAY. L. L. Gol'din, L. K. Peker, and G. I. Novikova. Uspekhi Fiz. Nauk, 59, 459-552(1956) July. (In Russian)

Alpha-decay data are reviewed and analyzed. The experimental techniques of α-γ correlation, the classical theory of α decay and the α decay on the ground level of the daughter nucleus are described and tabulation and graphical forms given. Also, the non-spherical forms of nuclei, the rotational structure of excited levels and α ray thin structure as well as the intensity lines in α spectra are discussed. The tables of allowed transitions in odd nuclei, the schemes of α decay for U^{233}, Th^{229}, Pa^{231}, and Ac^{227} levels, and tables for excited level (2+) of odd-odd nuclei are presented. An appendix of up to date data of α-radioactive isotopes (data for Apr. 1, 1956) is attached. (R.V.J.)

SHIELDING

1382

SELF-SHIELDING OF LUMPED-POISON MIXTURES. H. Hurwitz, Jr. and P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 1, 438-40(1956) Oct.

It is frequently desirable in constructing a reactor to introduce poison material as an inhomogeneous mixture or suspension in some other substance rather than in the form of the pure absorbing material. A method is given to show how to extend self-shielding factors previously calculated for homogeneous mixtures of various geometrical shapes to the case of inhomogeneous mixtures of poison with other material, under the assumption that the poison is present in low volume concentration. For this assumption the result is quite simple: the self-shielding factor of the mixture is calculated in the usual way, except that the macroscopic absorption cross section of the poison material is replaced with the self-shielded cross section of the poison lumps in the mixture. (auth)

SPECTROSCOPY

1383 NP-6143

Columbia Univ., New York. Columbia Radiation Lab. RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 3 [for] June 16, 1956 through September 15, 1956. P. Kusch. Sept. 15, 1956. 43p. DA Project No. 3-99-10-022. (CU-5-56-SC-64630-Phys.)

Several four-millimeter magnetrons were tested for harmonic power output and were able to deliver one or two orders of magnitude more power than nay other known harmonic device at wavelengths of 2.0 and 1.4 mm. In the generation of millimeter waves by Cherenkov radiation, a system was assembled and preliminary tests on a trial electron gun was made. The magnetic moment of CO was accurately measured and the rotational frequencies of $C^{12}O^{16}$ and $C^{12}O^{16}$ were measured to permit the calculation of the $C^{12}C^{13}$ mass ratio. A twelve-electrode focuser was tested for the maser (microwave amplification by stimulated emission of radiation). Focusing action is about four times more effective than that of the four-electrode type. The operation of the Pirani gage system for measuring beam collimation was accepted. A projected resonant traveling wave tube for a power oscillator at $\lambda = 2.5$ was described. It will deliver about 100 watts around 2.5 cm with a tuning range of a few percent. Observations of antiferromagnetic resonance in MnF_2 were extended to lower temperatures and higher frequencies. The required stability of the klystron frequency in the atomic beam emission spectrometer was obtained. A beam of metastable singly ionized He^3 was produced and the hyperfine structure was measured. (F.S.)

1384

ISOTOPIC SHIFT IN THE He II SPECTRUM. P. S. Kireev. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 108, 427(1956) May 21. (In Russian)

Investigations were made of the isotopic shift on the lines of ionized helium He^3II and He^4II for transition $n = 4 \rightarrow n = 3$. A diagram is shown for the positions of the intensity components on the lines of He^4(one order) and He^4 (two orders) obtained on the standard of 2.5 mm thickness with a short exposure. The isotopic shift obtained for all component positions was $\delta\nu = 0.932\ cm^{-1}$. The shift conditioned by the differences in isotopic mass of helium was 0.957^{-1} cm. (R.V.J.)

THEORETICAL PHYSICS

1385

NEW METHODS FOR MODEL TEST AND CALCULATIONS OF RELATIVISTICALLY CHARGED PARTICLE TRAJECTORIES IN ELECTROSTATIC FIELDS. A. M. Strashkevich (Kiev Polytechnic Inst.). Doklady Akad. Nauk 108, 440-6(1956) May 21. (In Russian)

A new interpolation method is offered for plotting trajectories for relativistically charged particles. Tabulations are presented for relativistic electron trajectories in homogeneous fields. The potential initial point was taken as 4×10^5 v. The initial angle of deflection of the trajectory to axis χ was 75°; the field gradient was directed along the axis χ; $\Delta\phi = \phi\Delta\chi = 4 \times 10^3$ v; $\Delta\chi$ was taken as the scale unit. To separate the errors within permissible interpolation, all graphic operations were replaced by mathematical calculations which produced sufficiently accurate results. (R.V.J.)

1386

MAGNETIC MOMENTS OF THE NUCLEONS. S. K. Kundu (Indian Assoc. for the Cultivation of Sci., Calcutta). Indian J. Phys. 30, 450-4(1956) Sept.

It has been shown here how the magnetic moment of the neutron varies with cut-off limit of the momentum of the meson which the neutron emits and reabsorbs. Moreover, the influence of the magnetic field on the proton is included in the energy denominator of the perturbation matrix elements. (auth)

1387

ENERGY OF A MANY-PARTICLE SYSTEM. W. B. Riesenfeld and K. M. Watson (Univ. of Wisconsin, Madison). Phys. Rev. 104, 492-510(1956) Oct. 15.

A formulation of the energy eigenvalue problem for a many-particle system is presented in several alternative forms and, following Brueckner and his collaborators, the energy of the system is expressed in terms of solutions to the two-body problem. This work bears considerable re-

semblance to Brueckner's "linked cluster" expansion. The present expansion is derived with the aid of an ordering operator and involves a sequence of "nearest neighbor" interactions. The particles tend to form "chains," the sequence of approximations involving "two-particle chains," "three-particle chains," etc. The rapidity of convergence of the method depends on the particle density and "temperature" and on the nature of the force between particles. The method lends itself readily to use in statistical mechanics. Some applications to the calculation of the equation of state of a gas are included. (auth)

URANIUM AND URANIUM COMPOUNDS

1388

X-RAY DIFFRACTION DETERMINATION OF THE COEFFICIENTS OF EXPANSION OF ALPHA URANIUM. J. R. Bridge, C. M. Schwartz, and D. A. Vaughan (Structural Chemistry Div., Battelle Memorial Inst., Columbus, Ohio). J. of Metals 8, (Sect. II), 1282-5(1956) Oct.

The unit cell dimensions of orthorhombic U have been determined over the temperature range −253 to 640°C. Above room temperature (27°C), these data were found to fit the equations $a_t = a_{27}[1 + 17.2 \times 10^{-6}(t-27) + 30.8 \times 10^{-9}(t-27)^2]$, $b_t = b_{27}[1 - 9.2 \times 10^{-6}(t-27) + 40.4 \times 10^{-9}(t-27)^2 - 67.5 \times 10^{-12}(t-27)^3]$, $c_t = c_{27}[1 + 25.1 \times 10^{-6}(t-27) - 21.3 \times 10^{-9}(t-27)^2 + 57.5 \times 10^{-12}(t-27)^3]$. Mean coefficients were computed. Over the range −253 to 100°C, these were compared with dilatometer data. (auth)

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CREEP OF ALPHA URANIUM DURING IRRADIATION WITH NEUTRONS. A. C. Roberts and A. H. Cottrell (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 1, 711-17(1956) Aug.

During neutron irradiation at 100°C, alpha uranium creeps slowly (e.g. 10^{-7} per hour) under external stresses of order of one-hundredth of the normal yield stress of the metal at that temperature. This effect is predicted as a consequence of the phenomenon of 'radiation-growth' which occurs in uranium, and is then confirmed by creep experiments on helical springs of natural uranium in a flux of 1.3×10^{12} thermal neutrons per cm^2 per sec. In addition to this steady-state creep, transient effects occur at the start of irradiation and when the neutron flux is removed. (auth)